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INTRODUCTION

CHAPTER 1
INTRODUCTION

INTRODUCTION

Often noted for their unique beauty and recreational opportunities, the Wasatch mountains bordering the Salt Lake Valley's east side are also a primary source of quality culinary water. Over the years, several steps have been taken to identify primary watershed areas and prepare resource management plans designed to protect this valuable resource. The most recent study, Salt Lake City's 1999 Watershed Plan, provides management objectives and directives for City Creek, Red Butte, Emigration, Parleys, Millcreek, Big Cottonwood and Little Cottonwood canyons.

Recognizing the need to proactively protect and manage its watershed resources, the Sandy City Department of Public Utilities began a process in the summer of 2000 to develop a watershed plan for the canyons directly east of the City. The Sandy City effort was designed to complement Salt Lake City's plan and extend watershed protection measures to additional Wasatch Front canyons.

The area encompassed by the Sandy City Watershed Plan includes seven canyons used by the City and others as culinary water sources. From north to south, these canyons include: Little Cottonwood, Bell, Middle Fork of Dry Creek, South Fork of Dry Creek, Rocky Mouth, Big Willow and Little Willow. For purposes of this study, Sandy City has defined the term "watershed" as the total land area that drains into an existing or proposed culinary water diversion point. Once adopted, Sandy City watershed management guidelines and regulations will apply to these areas. A map of the watershed area and diversion points may be found on page 1-5.

Sandy City also receives a significant portion of its culinary water from the Provo River through the Salt Lake City aqueduct. A section addressing Provo River watershed issues has been included as part of this study.

Consistent with the City's primary watershed management objectives of maintaining water quality and protecting water resources, the Sandy City Watershed Plan encourages multiple uses within the watershed as long as these activities do not adversely impact water quality. Currently, water quality appears to be excellent, however, concern over potentially deteriorating conditions has led to recommendations in this plan to protect and improve Sandy City's watershed

conditions.

Planning Process

Salt Lake City's watershed plan includes objectives encouraging other municipalities, specifically Sandy City, to "become more involved in watershed management" activities. In response to this invitation and with an interest in protecting their community's water resources, the Sandy City Public Utilities Department initiated the process to prepare a Sandy City-specific watershed plan. By design, the Sandy City process utilizes the Salt Lake City plan as a model.

Sandy City's watershed planning project formally began with a public scoping meeting held on June 14, 2000. Fifteen residents attended this work session. The purpose of this meeting was to solicit citizen input concerning watershed management issues, assess current use of the canyons, and identify community watershed/water quality protection priorities. Comments gathered at this meeting were compiled by project consultants and reviewed by the Public Utilities Department. These issues became the focus of the planning process and remaining public workshops.

Specific topics discussed by residents and resource experts during the scoping meeting include: protecting the City's water rights and interests; maintaining and improving water quality; protecting watershed resources; identifying canyon use levels, types of uses, and associated impacts; educating community leaders and citizens concerning watershed issues; and developing partnerships with other communities and agencies to address watershed management issues and pursue resource management objectives. A list of the issues discussed by meeting participants is attached as Appendix C, *Issues Identified in Scoping Meetings*.

To assist project consultants refine citizen input and prepare a draft watershed plan, the City organized a Citizen's Advisory Committee including representatives from various interests within the watershed , as well as water resource experts. Committee activities included a watershed tour and five work sessions. During the latter, participants discussed each watershed "priority issue" in detail. These discussions included developing community watershed management goals and alternative implementation strategies for each topic. Depending on the topic discussed, members of the committee or other "experts" were invited to present background information and assist the group in developing a recommended approach. The results of these discussions are reflected in the objectives and recommendations section of this document (see Chapter 2).

Based on community input and Public Utilities Department direction, a *draft* plan was prepared. This document was reviewed by the advisory committee and presented to the City's Public Utilities Advisory Board (PUAB) and Planning Commission for comment. The plan was then forwarded to the City Council for formal adoption. Following a public hearing in September 2002, the *draft* plan was unanimously accepted by the Council as a working document designed to protect the City's watershed interests and preserve water quality.

In addition to the Sandy City plan, several other plans are applicable to the watershed area. These plans include the U.S. Forest Service Wasatch-Cache Forest Plan (1985), the Salt Lake County Little Cottonwood Canyon Plan (1973), the Salt Lake County Wasatch Canyons Master Plan (1989), the Town of Alta General Plan (1992), and the Salt Lake City 1999 Watershed Management Plan.

WATERSHED PLAN MANAGEMENT OBJECTIVES (Overview)

Successful implementation of the Sandy City Watershed Plan will achieve a future condition in the project canyons that maintains excellent water quality and protects the associated watershed resources. The City's Department of Public Utilities' management policies and procedures will emphasize water quality first and multiple use of the watershed second. Through these efforts, the canyons will be protected to maintain a healthy ecological balance with stable environmental conditions, healthy streams and riparian areas, and minimal sources of pollution. Existing and potential uses that could lead to the deterioration of water quality will be limited, mitigated, or eliminated. To the extent that a proposed development or activity poses a potential impact to the watershed or water quality, Sandy City will either oppose, or seek to modify, regulate, or otherwise influence such proposed development or activity in order to eliminate or mitigate potential impacts.

All jurisdictional agencies involved in monitoring and permitting development in the watershed will become aware of and involved in the development proposal process. In this light, all applicable community, county, and agency "development suitability criteria" (such as slope restrictions, vegetation removal, and setbacks) will be carefully reviewed and subsequent regulations strictly enforced. Variance applications will be carefully reviewed to ensure water quality and watershed resources are not adversely impacted. It is anticipated that once all relevant jurisdictional agencies understand and share a common vision for the Valley's watershed areas, implementing watershed management objectives will become a cooperative endeavor.

In addition, public and private partnerships will be fully utilized to effectively manage the watershed. New partnerships will be continually sought to support effective and efficient management of the watershed resources.

Many people use the watershed each year for a variety of recreational activities. It is anticipated that as management objectives of the Sandy City Watershed Plan are implemented, uses and use levels will be appropriately managed. As stated, recreation facilities (restrooms, parking lots, trails, picnic areas, and camping sites) will be permitted within the watershed only if they can be sited, designed, and maintained in a manner that adequately protects water quality. Another measure which will be used to decrease recreational impacts is an extensive watershed education program. This program will be designed to educate watershed users about the importance of environmentally healthy watershed areas and the associated benefits in maintained/improved water quality.

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Sandy City Watershed Project Area

Legend

Watershed

- Upper Little Cottonwood
- Lower Little Cottonwood
- Upper Bell Canyon
- Lower Bell Canyon
- Dry Creek / Middle/So Fork
- Rocky Mouth
- Big Willow
- Little Willow
- Treatment Plants
- Diversions
- Waterways

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SANDY CITY
1893
STATE OF UTAH

Date: 4/02/2001

[Insert Watershed Map]

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RECOMMENDATIONS

CHAPTER 2
RECOMMENDATIONS

INTRODUCTION

This chapter articulates the City's watershed management objectives and identifies a range of appropriate implementation strategies for each statement. As described in Chapter 1, these objectives and subsequent recommendations were developed with input from the general public, water providers, resource specialists, and land managers/owners through a series of public open houses/field trips, citizens' advisory committee work sessions, and Department of Public Utilities discussions. All of the stated objectives and recommendations are consistent with the City's overarching goal of maintaining and improving water quality within the identified watershed area.

This chapter is organized by the following topics:

A. PARTNERSHIPS
B. WATERSHED EDUCATION
C. WATER QUALITY MONITORING
D. WATERSHED LAND USE/DEVELOPMENT
E. DISPERSED RECREATION
F. RECREATIONAL TRAILS & FACILITIES
G. WILDFIRE PREVENTION, MANAGEMENT & MITIGATION
H. FLOODWATER MANAGEMENT & MITIGATION
I. CANYON-SPECIFIC GUIDELINES
J. PROVO RIVER WATERSHED

Each section begins with a City-identified watershed area/resource objective, followed by a brief narrative describing the community's management direction for that particular issue/topic. Specific recommendations supporting each objective are also included.

Recommendations/management directives presented in sections A through H are to be implemented "watershed wide". Section I, Canyon-specific, includes recommendations to be implemented on a canyon-by-canyon basis. Section J, Provo River Watershed, applies to the City's Provo River watershed interests as noted.

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A. PARTNERSHIPS

OBJECTIVE: Encourage partnerships between Sandy City and other watershed interests to:

a. *Educate* the public on acceptable watershed usage;
b. *Enforce* regulations on usage;
c. *Coordinate* and manage watershed resources; and
d. *Fund* watershed management and improvement projects.

In this effort, the Sandy City Public Utilities Department will pursue partnerships with many groups. Potential partners include:

1. Sandy City Corporation
   - Public Utilities Department
   - Community Development Department
   - Parks & Recreation Department
   - Police Department
   - Animal Control Department
   - Fire Department
   - Community Coordinators
2. United States Forest Service
3. Salt Lake County Government
   - Sheriff's Office
   - Planning Department
   - Fire Department
   - Parks & Recreation Department
   - Public Works Department (Flood Control)
4. Salt Lake Valley Health Department
5. Salt Lake City Corporation
   - Public Utilities Department
6. Town of Alta
   - Marshal's Office
   - Planning Department
   - Fire Department
   - Parks Department
   - Public Utilities Department
7. Water Providers
   - The Metropolitan Water District of Salt Lake & Sandy
   - Jordan Valley Water Conservancy District
   - Water Pro (Draper Irrigation Company)
   - Bell Canyon Irrigation Company
   - North Dry Creek Irrigation Company
8. Provo River Water User's Association
9. Private Property Owners/Developers

10. Neighboring Communities
11. Jordan School District
12. Research Centers & Universities
13. Civic Groups & Special Interest Groups
14. Sanitary Sewer Districts
    - Cottonwood Improvement District
    - Sandy Suburban Improvement District
    - Salt Lake County Sewer Improvement District
15. State Department of Environmental Quality
16. Business & Private Sector

Currently, Sandy works closely with many of these entities on other projects. Sandy will seek to further these partnerships in relation to watershed education, enforcement, coordination, and funding issues.

This list of potential partners for Sandy City in watershed management is not exhaustive. Potential partners are likely to make themselves known throughout the implementation process. Sandy City will seek to form partnerships that meet specific watershed objectives outlined above. This may be accomplished by forming a watershed-wide coordination committee.

Recommendations and Potential Partnerships

1. Form a watershed-wide coordination committee to meet bi-annually to deal with issues affecting watershed resources along the Wasatch Front, coordinate different plans/jurisdictions.

2. The following are potential partnerships for watershed education, police, enforcement, cooperation/management, and funding:

Watershed Education (Potential Partners)

1. Sandy City
   - Public Utilities Department (e.g. brochures, pamphlets)
   - Parks & Recreation Department (e.g. classes, signage)
   - Police & Fire Departments (e.g. watershed officers in schools)
   - Community Development Department (e.g. code enforcement)
2. United States Forest Service (e.g. interpretive rangers, Silver Lake Education Center in Big Cottonwood Canyon, materials)
3. Salt Lake County
   - Sheriff's Department (e.g. watershed officers; provide "in-the-field" contact education)
   - Parks & Recreation Department (e.g. interpretive trails, signage, naturalist-in-residence for Dimple Dell Regional Park)
4. Salt Lake Valley Health Department (e.g. Salt Lake County Storm Water Coalition, inspectors, enforcement, pamphlets, brochures, etc.)

5. Salt Lake City

- Public Utilities Department (e.g. materials, mailings, data sharing)

6. Town of Alta
   - Public Utilities Department (e.g. brochures and mailings)
   - Parks Department (e.g. trail and park signs)
   - Marshal and Fire Departments (e.g. watershed officers/enforcement, "in-the-field" contact and education)
   - Planning Department (e.g. development and code enforcement)
7. Water Districts and Water Providers (e.g. materials, mailings, data sharing)
8. Provo River Water Users Association (e.g. signage, outreach, data sharing)
9. Neighboring Communities (e.g. cooperate between schools, use school district etc.)
10. Public School System (e.g. rangers in class, conservation)
11. Research Centers & Universities
12. Civic Groups (e.g. county library events, community outreach, newsletters, Boy Scouts)
13. Special Interest Groups (e.g. equestrian clubs, climbing/hiking clubs, back country education)
14. Watershed-Wide Coordination Committee (e.g. evaluate and determine program effectiveness)
15. Sanitary Sewer Districts

ENFORCEMENT OF WATERSHED POLICIES (Potential Partners)

1. Sandy City
   - Public Utilities Department (e.g. watershed officer, administer permits)
   - Parks & Recreation Department (e.g. educate employees on enforcement procedures/methods.)
   - Police & Fire Departments (e.g. patrol, watershed officers)
   - Animal Control Department
   - Community Development (e.g. code enforcement)
2. United States Forest Service (e.g. watershed rangers, SLC)
3. Salt Lake County Government
   - Sheriff's Office (e.g. watershed officers)
   - Planning Department (e.g. enforce, revise development code to fit with recommendations from the watershed plan.)
   - Fire Department
   - Parks and Recreation Department (e.g. teach methods/procedures for enforcement of policies.)
4. Salt Lake Valley Health Department (e.g. enforce current county regulations)
5. Salt Lake City (e.g. coordinate efforts in Little Cottonwood)
6. Town of Alta
   - Marshal and Fire Departments (e.g. patrol and watershed officers)
   - Planning Department (e.g. revise and enforce development code consistent with watershed plan)
7. Water Providers (e.g. ordinance posting, inspections)
8. Provo River Water Users Association and interests
9. Private Property Owners/Developers (e.g. access to trailheads, reporting)
10. Neighboring Communities (e.g. encourage the adoption of similar policies

and ordinances to foster consistency in watershed management, coordination, cooperation, and inspections)

11. Special Interest Groups (e.g. equestrian clubs, climbing/hiking clubs, back country education)
12. Watershed-Wide Coordination Committee (e.g. coordinate cross-jurisdictional enforcement of watershed policies.)
13. Sanitary Sewer Districts

GENERAL WATERSHED MANAGEMENT/COORDINATION (Potential Partners)

1. Sandy City
   - Public Utilities Department
   - Community Development Department
   - Parks & Recreation Department
   - Police Department
   - Fire Department
2. United States Forest Service
3. Salt Lake County Government
   - Sheriff's Office
   - Planning Department
   - Fire Department
   - Parks and Recreation Department
   - Public Works Department
4. Salt Lake Valley Health Department
5. Salt Lake City Corporation
6. Town of Alta
   - Public Utilities Department
   - Marshal's Department
   - Planning Department
   - Parks Department
   - Fire Department
7. Water Providers
8. Provo River Water Users Association (e.g. Encourage Upstream Communities to adopt watershed friendly ordinances in accordance with Sandy and Salt Lake City Watershed Management Plans.)
9. Private Property Owners (e.g. Adopt-A-Trail etc)
10. Neighboring Communities (e.g. cooperate through water districts and companies to protect mutual sources)
11. Research Centers & Universities
12. Special Interest Groups (e.g. use back country hikers, climbers, horsemen to clear, establish, and maintain trails, etc.)
13. Watershed-Wide Coordination Committee
14. Sanitary Sewer Districts

FUNDING FOR WATERSHED ENHANCEMENT (Potential Partners)

1. Sandy City
   - Public Utilities Department (e.g. water fund)
   - Parks & Recreation Department (e.g. user fees)

2. United States Forest Service (e.g. grant money)
3. Salt Lake County Government
   - Parks & Recreation Department (e.g. user fees)
4. Salt Lake City Corporation (e.g. acquisitions in Little Cottonwood)
5. Town of Alta
   - Public Utilities Department (e.g. water fund)
   - Planning Department (acquisitions in Town of Alta and Little Cottonwood Canyon)
6. Water Providers (e.g. watershed assessment)
7. Provo River Water Users Association
8. Private Property Owners/Developers (e.g. encourage rehabilitation of watershed areas by responsible parties, land-use regulation etc.)
9. Neighboring Communities (e.g. solicit financial support of neighboring communities for watershed improvement and future municipal acquisition)
10. Research Centers & Universities
11. Special Interest Groups & Civic Groups (e.g. work with civic groups on a user based fee system)
12. Watershed-Wide Coordination Committee (e.g. work with government and private entities to fund watershed improvement etc.)
13. Sanitary Sewer Districts

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B. WATERSHED EDUCATION

OBJECTIVE: Educate Sandy City residents, community leaders, partnering agencies, property owners, developers, and watershed users concerning watershed issues, management objectives, and policy implementation partnerships and programs.

In this effort, Sandy City will support proactive, educational programs that promote watershed resource protection and awareness. This education effort will address issues "watershed-wide" and include partnerships with other communities and federal, state, and local watershed and water resource interests. Programs and activities will provide information and materials to schools, community leaders, and the public and encourage interaction/dialogue between the public and resource specialists. Watershed issues presented and discussed may include:

- Sandy City watershed management objectives
- Sandy City watershed management policies and procedures
- Watershed "use" guidelines and regulations
- Watershed uses and associated environmental and water quality impacts
- Sandy City water resources and associated uses (allocations)
- Water conservation programs (including types and levels of use, xeriscaping, etc.)
- Watershed resource management partners
- Sandy City-specific watershed boundaries

It is anticipated that community education programs and activities will also serve as a catalyst for on-going communication with elected officials, keeping them informed about emerging watershed issues and the changing environment affecting watershed management.

As appropriate, Sandy City will solicit federal and state involvement and assistance in watershed education programs and funding strategies.

RECOMMENDATIONS

1. Support local, state, and federal watershed/water resource education programs and community outreach efforts. As applicable, these activities will incorporate Sandy City's watershed management policies and objectives.

2. Support Wasatch Front watershed/water resource education and information sites (e.g., the Silver Lake Interpretive/Education Center and trail head kiosks). Sandy City will expand their efforts to include signs and information kiosks at high use sites within the community's watershed (e.g., community recreation facilities, parks, picnic areas, and trail heads).
3. Coordinate with other watershed/water resource interests and organizations to

develop and distribute watershed education materials (e.g., articles, newsletters, brochures, etc.).

4. Develop and distribute a Sandy City watershed fact sheet/newsletter to educate residents about watershed issues and associated watershed management objectives. Distribution points may include City Hall, local libraries, public schools, community recreation facilities, parks, trail heads, and picnic areas. Distribution/education opportunities also include City-sponsored activities and events such as Sandy Pride Day.

5. Support a K-12 watershed education curriculum including materials.

6. Coordinate with other Wasatch Front watershed/water resource management agencies and interests to develop and adopt a comprehensive Wasatch Front watershed management program and accompanying logo.

7. Solicit media coverage of watershed and water resource management issues.

8. Implement a simplified watershed-wide educational sign program. Signs will be designed to identify watershed boundaries, convey watershed management objectives, and identify relevant use restrictions in a concise and informative manner. Construct interpretive displays/signs at trail heads and in high use areas throughout the watershed (at a minimum). Sign location is critical.

9. Encourage community leader education and outreach activities. These efforts will be designed to educate community decision makers concerning watershed issues and alternative management approaches. Activities may include reviewing water quality monitoring data on a regular basis, participating in watershed tours, and sponsoring public work sessions discussing watershed management issues.

10. Solicit federal and state assistance in watershed education programs and funding.

11. Increase educational "contact" opportunities within the watershed between resource specialists and watershed users.

12. Implement an "adopt-a-watershed" program.

13. Promote watershed-oriented service projects for civic, youth, and special interest groups within the community.

C. WATER QUALITY MONITORING

OBJECTIVE: Establish a water quality monitoring program for the Sandy City Watershed. This effort includes completing a comprehensive baseline report reflecting current conditions and developing/implementing an ongoing monitoring program.

As noted, Sandy City and partner agencies will pursue a comprehensive and consistent approach to water quality monitoring. Based on the information and insights gained in the initial baseline study, an ongoing monitoring program will be developed. This program will identify the tests to be conducted, location of testing, and an appropriate testing schedule to ensure current water quality is maintained, and that adverse impacts to watershed resources, and water quality can be identified, and addressed in a timely manner.

This plan to monitor water quality in Sandy's watershed will be accomplished in cooperation with Salt Lake City Public Utilities, the Metropolitan Water District of Salt Lake & Sandy, Salt Lake Valley Health Department, Jordan Valley Water Conservancy District, Water Pro and other water providers within the watershed area, and the Town of Alta.

As an example, Salt Lake City's current program for water quality monitoring includes:

- Microbiological tests in the water sources at the intake (bi-weekly)
- Tests for nitrates/phosphates (monthly in the summer season)
- Inorganics (fuels/fertilizers) (bi-monthly)
- Organics (as deemed necessary)

RECOMMENDATIONS

1. Cooperate with Salt Lake City Public Utilities, Metropolitan Water District of Salt Lake & Sandy, Jordan Valley Water Conservancy District, Salt Lake Valley Health Department, Water Pro and other water providers and the Town of Alta to plan, fund and perform monitoring activities.

2. Complete a "baseline" study consisting of the following:
   - a *microbiological test*, including total coliform, fecal coliform/e. coli, and microbial contaminants
   - an *inorganics test*, focusing on lead, copper, arsenic, and other metals potentially high in the area, and
   - an *organics test*, [TOC] which will determine among other things phosphate and nitrate levels - both of which are indicators of organic content.
3. Complete a comparison analysis of similar canyons/streams along the Wasatch

Front. This may also be helpful in determining possible management solutions and policies.

4. Generate and maintain a water quality database for the waters in the plan area.

5. Complete a comparison analysis of Sandy City's water quality standards and state/federal water quality standards and regulations. This analysis should include pending state and federal standards and regulations including the EPA's *Enhanced Surface Water Treatment Rule, Proposed Groundwater Rule [GWR]*, and *Source Water Protection Rule.*

6. Conduct seasonal analyses to determine potentially fluctuating contaminants.

7. Develop an ongoing monitoring program including an analysis of the following:
   - irregularities found in the initial baseline study
   - elements that have the potential to change over time, e.g., microbiological factors (including e. coli), coliform levels, phosphate, and nitrate levels (shows septic pollution), and TOC's (Total Organic Carbons), and
   - testing strategically above and below developed areas within the watershed boundaries to determine specific source contaminants.

8. Conduct a quarterly review of monitoring results to determine if any watershed management objectives, policies, or procedures need to be modified. As deemed necessary and appropriate, changes to the City's water quality monitoring program and Watershed Plan will be made in a timely manner.

D. WATERSHED LAND USE & DEVELOPMENT

OBJECTIVE: Ensure that development occurring within the watershed does not adversely impact watershed resources or water quality.

In this effort, Sandy City will continue to adopt and enforce land use and development regulations/guidelines applicable to sensitive lands including watersheds, water bodies, stream corridors, and groundwater recharge areas.

Specifically related to watershed areas, the City may permit development as long as appropriate measures are taken to ensure that watershed resources and water quality are not adversely impacted.

Sandy City will work with neighboring communities, Salt Lake County, United States Forest Service (USFS), and private property owners to cooperatively address watershed development issues. Relating to government agencies, this cooperation will include reciprocal notification of watershed development proposals and projects, mutual participation in relevant planning activities, and shared enforcement of watershed development/land use regulations and ordinances.

In addition, the City will work with private property owners within the watershed to identify areas suitable for development (based on the City's development code and sensitive lands ordinance) and determine how these areas may be appropriately utilized.

Existing development and land uses that are inconsistent with the City's watershed management policies and ordinances will be reconciled through the City's policies and procedures addressing nonconforming land uses. "Resident" domestic animals (animals residing at permanent residences within the identified watershed area) are allowed only on private property subject to current Sandy City animal control regulations.

EXISTING SANDY CITY LAND DEVELOPMENT CODE

Existing Sandy City land use development policies and practices are reflected through the City's Land Development Code. These ordinances apply to all properties within the jurisdictional boundaries of Sandy City. A summary of applicable Sandy City ordinances can be found in Appendix D.

Due to the City's extraterritorial jurisdiction rights to protect its watershed resources, watershed management ordinances adopted by the City apply to all areas within the City's identified watershed boundaries.

RECOMMENDATIONS

1. Adopt watershed land-use regulations that complement other city sensitive land-use regulations and guidelines. Development guidelines/regulations reflected in other plans relevant to Sandy City's watershed include:
   - "Development setback" for water feature and wetlands (DEQ - Source Water Protection Plan)
   - 100 foot "no development" setback for water feature and wetlands (Wasatch Canyons Plan)
   - >30% slope development restriction (Wasatch Canyons Plan)
   - All cities and towns have the right to protect a stream or source from which their water is taken "for 15 miles above the point from which it is taken and for a distance of 300 feet on each side of the stream." Cities of the 1st Class (including Sandy) have authority to protect the entire watershed (Utah Code Annotated Section 10-8-15).

2. Specifically identify the City's watershed areas as a "sensitive area" subject to development regulations and guidelines as stated in the City's current development code and sensitive lands ordinances.

3. Support enforcement of the City's current development code and sensitive lands ordinances.

4. Coordinate with public entities and departments (including the Forest Service, Salt Lake County, Salt Lake Valley Health Department, Town of Alta, and Salt Lake City) having jurisdiction over the canyons to ensure enforcement of all applicable land use and public health regulations.

5. Sandy City will encourage these entities to critically evaluate all proposals that may attract new user groups or large numbers of individuals.

6. Review all land use/development variance and building permit requests for sites within the watershed (Sandy and Salt Lake County).

7. Actively participate in Salt Lake County's pre-application meeting for all developers proposing watershed development. Request to be placed on notification/mailing list.

8. Review the Wasatch Canyons Master Plan as it relates to watershed development policies and guidelines. Adopt measures, that meet or exceed, Sandy City's watershed protection standards/efforts.

9. Work with Salt Lake County, the Town of Alta, and neighboring watershed communities to update the Wasatch Canyons Master Plan to reflect current canyon uses, issues, and objectives. Plan "area" should be expanded to include Bell, Middle Fork of Dry Creek, South Fork of Dry Creek, Rocky Mouth, and Big and Little Willow canyons.

10. Encourage appropriate and consistent water quality monitoring above and below developed watershed areas to assess effects on watershed resources, particularly water quality.

11. Assist neighboring communities, water providers, the Town of Alta, and Salt Lake County in developing a watershed-wide ordinance regulating the use of herbicides, pesticides, and fertilizers.

12. Encourage Salt Lake County and the Salt Lake Valley Health Department to draft and adopt a "mandatory connection" ordinance consistent with Sandy City's Sewage Disposal Ordinance (Sandy City Code - Title 18.).

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E. DISPERSED RECREATION

OBJECTIVE: Provide a framework that allows recreational usage in the watershed area without adversely impacting water quality.

Sandy City's watershed management decisions will reflect a priority to maintain existing high water quality standards in the Sandy Watershed, while accommodating recreational opportunities that do not compromise water quality.

Current uses within the watershed area include, but are not limited to:

- Camping/Backpacking
- Hiking & rock climbing
- Mountain biking
- Horseback Riding
- Fishing
- Swimming/Wading
- Skiing & Winter Recreation
- Picnicking
- Domestic Pets
- Off-Highway-Vehicle (OHV) Use (Alta Town)

This section presents Sandy City's watershed-wide policy toward recreation uses and associated watershed resources. Canyon-specific recreation objectives and policies begin on page 2-25.

RECOMMENDATIONS

1. Cooperate with the Forest Service and Town of Alta to educate recreationists in watershed areas about appropriate uses of the areas.

2. Cooperate & coordinate with the Forest Service, Town of Alta, appropriate city and county agencies, civic groups, and special interest groups to enforce recreation policies in the watershed.

3. Draft a Memorandum of Understanding (MOU) between Sandy City and the Forest Service and Town of Alta outlining a management policy geared toward managing unanticipated changes in recreational use.

4. Work with private property owners and law enforcement to ensure that private property rights are ensured.

5. Inform/educate the Sandy City Parks & Recreation Department, Bonneville Resource Conservation & Development [RC&D], and Draper City concerning Sandy's watershed policies.

6. Provide sanitary facilities at high use areas and trailheads.

7. Provide sign-in sheets at all trailheads.

ACTIVITY-SPECIFIC RECOMMENDATIONS

CAMPING/BACKPACKING - Consistent with current Forest Service regulations, the

following guidelines will be implemented:

1. Camp, cook, wash dishes, bathe, and bury human waste at least 200 feet from water sources and established trails.
2. Do not introduce detergents or other chemicals into water sources.
3. Allow camping only in developed camping areas or by permit.
4. Limit groups in the back country to ten or fewer persons.
5. Practice "Leave No Trace" camping (pack out trash, stay no longer than 3 days in one spot, camp 100 ft from other campers, seek to reduce damages to vegetation and erosion).
6. Limit firewood collection to dead wood from the forest floor. No live trees will be taken. Do not build fires in high elevations that have short growing seasons. Drench all fires completely before leaving the area. Some areas are closed to fires.
7. Prohibit fires in the Lone Peak Wilderness Area.

Hiking - (Refer to *Sandy Parks & Recreation "Hiking Guide"*)

1. Remain on established trails to reduce trail impacts and erosion. No "shortcuts" on switchbacks.
2. Respect private property.
3. Pack out all trash.
4. Observe proper trail etiquette.
5. Sandy City will work with property owners to ensure trailhead and canyon access.

Rock-Climbing - (Overnight expeditions can refer to camping for policies)

1. Pack out all trash.
2. Remain on established trails and routes.

Domestic Pets

1. No unauthorized domestic pets above culinary water diversion points.
2. Observe Sandy City animal control policies in residential areas within the watershed plan area.

Equestrian Use*

1. Allow horse riding within the watershed on a permit basis.
2. Observe trail etiquette and respect private property. Take necessary steps to reduce trail erosion by staying on established trails and not "shortcutting" switchbacks.
3. Remove manure from the trail and ensure that it is not disposed within 200 feet of any water resource.
4. Access the canyons through identified access points.
5. Require horsemen using the back country to feed their animals Forest Service-approved "weed-free" hay.

6. Allow equestrian use of city parks/trails in the watershed area subject to the following conditions:
   a. Horsemen must obtain a permit from the Public Utilities Department.

The permit will specify number of horses and duration of permit.

b. Horsemen must complete a special watershed education course.
c. Equestrian use will be limited to facilities/trails specifically designed and identified for that purpose.
d. All equestrian staging sites (associated with watershed use) must be maintained to a standard established by the Public Utilities Department.
e. Equestrian interest-sponsored/performed watershed trail maintenance activities will be coordinated with the Forest Service, Sandy City Public Utilities, Sandy City Parks Department, and permit holders.
f. Permit holders must obtain permission from property owners to cross private property (as necessary).
g. Permit holders will assume responsibility for enforcing these regulations.

*It should be noted that Sandy City reserves the right to prohibit this recreational use at any time or upon finding conclusive scientific evidence concerning the effects of horse use in watershed areas.

Mountain Biking

1. Allow mountain biking only on trails designed and identified for that use.
2. Observe proper trail etiquette and give pedestrians the right of way.
3. Pack out all trash.

Swimming

1. Prohibit swimming in rivers, reservoirs, and lakes above culinary water diversion points.

Winter Recreation/Skiing

1. Observe current Forest Service policies governing these activities.
2. Prohibit unauthorized motor vehicles (snowmobiles, Off-Highway-Vehicles (OHVs), etc.) within the identified watershed area.

Picnicking

1. Pack out all trash.
2. Allow fires only in developed campgrounds and fire rings.
3. Close day use areas at dusk.
4. Improve facilities in high-use areas as feasible.

Off-Highway-Vehicle (OHV) Use

1. Prohibit unauthorized OHV use within the identified watershed area.

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F. RECREATION TRAILS & FACILITIES

OBJECTIVE: **Accommodate public recreational trails and facilities within the watershed as long as doing so does not compromise the City's primary watershed management priorities, i.e., protecting water resources and maintaining water quality. All trails and recreational facilities within the watershed will be sited, constructed, and maintained in a manner consistent with these objectives.**

In general, trails traversing the lower watershed, including the Bonneville Shoreline Trail, will be "multi-purpose" trails designed to accommodate walking, jogging, and cycling. Trail corridors located below culinary water diversion points may also accommodate equestrian and domestic pet use. Upper watershed and "back country" trails will remain open to hiking and will be improved and maintained according to USFS "best management practices". A map of existing and proposed watershed-related trails can be found on page 2-35.

RECOMMENDATIONS

1. Add "protect watershed resources" and "maintain water quality" to the criteria used in identifying trail corridors and the location of trail-side facilities.

2. Implement and enforce existing Sandy City Development Code "trail location and construction" regulations including the following:
   - trail alignments should follow natural topography
   - vegetation disturbance should be minimized
   - erosion must be controlled during construction
   - cuts and fills may not exceed two feet in height

3. Require setback (distance) requirements from streams and water bodies for all existing and proposed picnicking, camping, and restroom facilities. All trails will be located outside of the stream channel and recognized riparian zone unless adverse impacts can be mitigated.

4. Establish setback (distance) requirements between trails/facilities and water management buildings/structures (diversion points, etc.).

5. Locate trails and associated facilities below diversion points where possible.

6. Unless otherwise provided, require that trails and facilities accommodating horses and domestic pets be located below diversion points and regulated according to Sandy City's animal control ordinance including:
   - All animals must be secured within an enclosure or adequately tethered

- All animals using public rights-of-ways (including trails) and facilities must be on a leash or tether, and
- Owners are responsible to clean up after their animals and dispose of waste in an approved receptacle.

7. Encourage USFS "best management practices" for trail construction and maintenance activities on all watershed trails.

8. Promote and encourage appropriate trail use (and users). This may be accomplished through education (signage, etc.) and consistent enforcement.

9. Require appropriate trail design and construction to minimize erosion and accommodate anticipated uses and levels of use.

10. Mountain biking will be allowed only on trails designated and designed for that purpose.

G. WILDFIRE PREVENTION, MANAGEMENT & MITIGATION

OBJECTIVES: Coordinate with resource management entities and private property owners to protect watershed resources and decrease wildfire potential within the project area.

Develop a wildfire prevention, management and mitigation plan to proactively address watershed wildfire issues and protect water quality.

Canyons within the Sandy watershed are characterized by dense, mature vegetation and steep slopes. Combine these factors with Utah's predominately dry climate and there is a high potential for large, catastrophic fires.

Direct fire damage to resources and property is only the initial consequence. Following a fire, burned areas are susceptible to additional problems (such as landslides, erosions, etc.) during and following subsequent storms. In extreme cases, excessive sediment and debris yield can adversely impact water quality. For these reasons, it is important that Sandy City consider developing and adopting fire prevention and post-fire mitigation strategies as part of their ongoing watershed resource protection efforts.

RECOMMENDATIONS

1. Adopt and enforce, as necessary and appropriate, wildfire prevention measures within the watershed area. These may include, but are not limited to, seasonal restrictions on open fires and fireworks.

2. Research and review federal and state agency-adopted wildfire prevention and mitigation plans for approaches, guidelines and strategies applicable to the Sandy watershed area and the City's primary objective to protect water quality.

   The City's wildfire prevention/mitigation plan may include the following:
   - Preventative guidelines and enforcement strategies,
   - Post-burn runoff and debris control measures,
   - Revegetation guidelines, and
   - Situation management policies and procedures.

3. Partner with Salt Lake City Public Utilities and the Natural Resource Conservation Service (NRCS) to expand their ongoing wildfire/watershed planning efforts to include Sandy City's watershed.

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H. FLOODWATER MANAGEMENT & MITIGATION

OBJECTIVE: Coordinate with resource management agencies and watershed property owners to protect water quality through appropriate floodwater management and impact mitigation planning.

As described in Chapter 3, the City's watershed is characterized by high snow pack and steep, narrow canyons. Elevations within the watershed range from 11,489' (Twin Peaks, Little Cottonwood Canyon) to 5,043' (lower diversion, Little Cottonwood Canyon). All of the canyons in the identified watershed include elevations over 10,000' and vertical drops over 5,000' to their respective culinary water diversion structures (distance as measured from upper ridge lines to diversion structures). In most of the canyons, this drop in elevation occurs in less than 5 "stream miles" and creates a significant potential for uncontrolled flooding.

In recent history, gradual increases in springtime temperatures and the canyons' dense, mature vegetation have limited damage to property and resources during spring runoff and periods of storm-induced flooding. As anticipated, overall water quality is somewhat reduced during peak flows and immediately following storm events due to increased solids content and turbidity. Under most circumstances, existing debris collection/separation facilities are adequate. In extreme situations, corrective treatment/bypass procedures are implemented and water quality impacts kept to a minimum.

In order to maintain overall water quality and protect City facilities located within the project area, it is critical that the Public Utilities Department coordinate and cooperate with watershed resource managers and property owners to identify and address potential flood hazard issues. It is anticipated that these planning processes and activities will incorporate and complement the City's efforts to implement the Sandy City Storm Water Management Plan and address other watershed management issues identified in this plan including fire prevention and mitigation (Section G), and appropriate land use and development standards/guidelines for vegetation removal, grading, cuts and fills, and slopes (Section D).

RECOMMENDATIONS

1. Partner with Salt Lake City, the United States Forest Service and other watershed property owners and interests to identify and address flood hazard related issues through a coordinated effort.
2. Research and review federal and state agency-adopted resource protection and flood prevention/mitigation plans for approaches, guidelines and strategies

applicable to the Sandy watershed area and the City's primary objective to protect water quality through floodwater control and mitigation measures.

The City's floodwater prevention/mitigation plan for the watershed may include the following:

- Watershed-specific land use and development standards/guidelines for vegetation removal and restoration, grading, cuts and fills, and unstable slopes;
- Appropriate watershed uses and use levels/locations;
- Floodwater preventative/mitigation measures and guidelines addressing facility design, stream stabilization and riparian corridor restoration;
- Location of flood prevention and debris control facilities; and
- Situation management policies and procedures.

I. CANYON-SPECIFIC GUIDELINES

OBJECTIVE: Implement canyon-specific watershed management objectives tailored to address the unique characteristics and uses of each canyon.

Sandy City's approach to watershed management includes watershed-wide policies covering such issues as education, partnerships, recreation, and land use/development. As applicable, canyon-specific recommendations address these issues based on each canyon's physical environment, use as a watershed resource, existing and anticipated uses, and ownership.

As part of their watershed plan, Sandy City has developed specific management recommendations for Little Cottonwood, Bell, Middle Fork of Dry Creek, South Fork of Dry Creek, Rocky Mouth, Big Willow, and Little Willow canyons as follows:

RECOMMENDATIONS

Little Cottowood Canyon (The following recommendations were also adopted by Salt Lake City in their 1999 watershed plan.)

RECOMMENDED MANAGEMENT APPROACH

1. Continue support of Alta Town's dog permit ordinance. Specific conditions include:
   a. limited number and type of permits are available (number of permits based on resident population according to the most recent National Census....~1 permit/10 residents, currently 41 permits);
   b. annual renewal process, both Alta Town and watershed tags are required;
   c. three distinct license classes and accompanying use restrictions (full-time, part-time, and temporary);
   d. mandatory leash law;
   e. mandatory "bag" and "clean up" (includes dog runs and cages);
   f. annual inter-department program assessment;
   g. same household permit "transfers" only;
   h. maximum one dog/household restriction;
   i. ticket and "three strike rule" enforcement approach; and
   j. time and location use restrictions (dog parks).

2. Work with Salt Lake City to revise and adopt an ordinance covering resident domestic pets outside of Alta Town limits (unincorporated areas).

3. Join Salt Lake City in developing a Memorandum of Understanding (MOU) with the Utah Department of Transportation (UDOT) to manage and maintain canyon road surfaces with special attention to water quality (surface runoff, salt, and deicing, snow removal, etc.)

4. Work with Salt Lake City, the USFS, and the Town of Alta to develop an overnight, back country use permit system for the lake basins. Associated guidelines would be consistent with USFS "best-management-practices" covering group size, appropriate use areas, and "no trace" camping practices.

5. Monitor proposals to expand ski area interconnects and respond to potential impacts on watershed resources.

6. Participate in Salt Lake City's "land acquisition" program for Little Cottonwood properties. Sandy City funding commitments would be based on "amount not to exceed" and "percent of total funds" agreements.

7. Coordinate with the Town of Alta to monitor their review and approval of development proposals and building permits.

Bell Canyon

Recommended Management Approach

1. Manage Bell Canyon through a two-tier approach:
   a. *Lower Bell Canyon* (Granite Divide Diversion to lower falls including Lower Bell Canyon Reservoir and surrounding trails) - permitted uses/activities include camping, hiking, fishing, and picnicking on approved trails and sites. Watershed resource management objectives may include improving sites and trails, mitigate impacts, and preserve water quality. Watershed resource protection activities may also include rehabilitation/revegetation of compacted soils and heavy use areas.
   b. *Upper Bell Canyon* (lower falls to watershed boundary including upper falls, Upper Bell Canyon Reservoir and Lone Peak Wilderness Area) - permitted uses include hiking; climbing; and short-term, permit-based, back country camping. All "back country" activities would be regulated by USFS "best management" and "Leave No Trace" practices.

2. Extend the reservoir's existing "no domestic pet", "no horse" policy to include all areas/trails above any drinking water source diversion point.

3. Support the Utah Division of Oil, Gas, and Mining (DOGM) in their abandoned mine discharge monitoring. Solicit DOGM monitoring of existing sites.

4. Coordinate with Salt Lake County to review development proposals and building permits in adjacent unincorporated areas.

Middle Fork and South Fork of Dry Creek Canyon

Recommended Management Approach

1. Manage lands within Middle Fork of Dry Creek and South Fork of Dry Creek as "day use" only areas (park hours, dusk-to-dawn closure, etc.). Hiking and picnicking would be allowed on approved trails. Consistent with existing Water Pro policies; no camping, campfires, horses, or domestic pets will be allowed on Water Pro-owned properties within these canyons.

2. Allow hiking and rock climbing on USFS properties.

3. Improve trails/facilities as necessary and feasible to accommodate anticipated uses and use levels.

4. Secure and maintain adequate and convenient public access through private holdings and development. Include public access as a consideration of development approval.

5. Work with private property owners, including Water Pro, to implement appropriate sensitive lands and watershed development regulations if these areas are proposed for development.

6. Work with private property owners to address and mitigate water quality/resource impacts related to existing development and land uses.

7. Coordinate with Salt Lake County to review development proposals and building permits in adjacent unincorporated areas.

Rocky Mouth Canyon

RECOMMENDED MANAGEMENT APPROACH

1. Manage lower Rocky Mouth as a "day use" only area (park hours, dusk-to-dawn closure, etc.). Hiking and picnicking would be allowed on approved trails and sites. Horses and domestic pets are not permitted in this area.

2. Improve existing trail and facilities to/at the falls to accommodate use levels and decrease turbidity (improve water quality).

3. Allow hiking; rock climbing; and short-term, permit-based camping (as regulated by USFS "best management" and "Leave No Trace" practices) on USFS properties.

4. Work with private property owners to implement Sandy City sensitive lands and watershed development regulations as areas are development.

5. Work with private property owners to address and mitigate water quality/resource impacts related to existing development and land uses

(waste water, drainage, waste disposal, etc.).

6. Coordinate with Salt Lake County to review development proposals and building permits in adjacent unincorporated areas.

7. Continue monitoring of naturally occurring contaminants (bat caves).

Big Willow Canyon

RECOMMENDED MANAGEMENT APPROACH

1. Manage lower (Water Pro entrance gate to diversion) Big Willow as a "day use" only area (park hours, dusk-to-dawn closure, etc.). Hiking and picnicking would be allowed on approved trails and sites. Consistent with existing Water Pro policies; no camping, campfires, horses, or domestic pets will be permitted on Water Pro-owned properties within in the canyon.

2. Allow hiking; rock climbing; and short-term, permit-based camping (as regulated by USFS "best management" and "Leave No Trace" practices) on USFS properties.

3. Improve trails and facilities as necessary to accommodate anticipated uses and use levels.

4. Work with private property owners, including Water Pro, to implement appropriate sensitive lands and watershed development regulations as these areas are proposed for development.

5. Coordinate with Salt Lake County to review development proposals and building permits in adjacent unincorporated areas.

Little Willow Canyon

RECOMMENDED MANAGEMENT APPROACH

1. Maintain quality of Little Willow water resources for potential culinary use.

2. Manage lower Little Willow (Bonneville Shoreline Trail to Water Pro diversion point) as a "day use" only area (park hours, dusk-to-dawn closure, etc.). Hiking and picnicking would be allowed only on approved trails. Consistent with existing Water Pro policies; no camping, campfires, horses, or domestic pets will be permitted on Water Pro-owned properties within the canyon.

3. Allow hiking; rock climbing; and short-term, permit-based camping (as regulated by USFS "best management" and "Leave No Trace" practices) on USFS properties.

4. Coordinate with Salt Lake County to review development proposals and building permits in adjacent unincorporated areas.

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Sandy City Watershed Trails Map

Legend

Watershed

- Upper Little Cottonwood
- Lower Little Cottonwood
- Upper Bell Canyon
- Lower Bell Canyon
- Dry Creek / Middle/So Fork
- Rocky Mouth
- Big Willow
- Little Willow
- Waterways
- Treatment Plants
- Diversions

Trails

- Existing 8 ft Multi-Use Path
- Existing Bike Path
- Existing Equestrian Path
- Existing Pedestrian Path
- Future Bike Path
- Future Equestrian Path
- Future Multi-Use Path
- Future Pedestrian Path

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SANDY CITY
1893
STATE OF UTAH

Date: 4/02/2001

J. PROVO RIVER WATERSHED

OBJECTIVE: **Take an active role in Provo River watershed management issues. Maintain a cooperative partnership among Provo River watershed interests (State Division of Water Resources, Provo River Water Users Association, Jordanelle/Deer Creek Technical Advisory Committee, etc.) to improve Provo River watershed conditions and protect water quality. (For purposes of this study, the identified Provo River watershed includes trans-basin diversions from the Duchesne and Weber Rivers.)**

RECOMMENDATIONS

Currently, Sandy City's interests in Provo River watershed management issues are represented and addressed through the Metropolitan Water District of Salt Lake City & Sandy (Metro) and their involvement with the Jordanelle/Deer Creek Technical Advisory Committee. As a contributing Metro member, the City will utilize District resources and expertise to pursue the following objectives:

1. Educate community leaders and citizens to recognize the Provo River drainage as a legitimate Sandy City watershed interest.

2. Identify and foster Provo River watershed interests, management agencies, and potential collaborative partnerships.

3. Actively participate in Provo River watershed planning and decision-making processes. This effort includes ensuring adequate representation and participation on applicable boards and committees.

4. Assist Mountainlands Association of Governments (MAG) in their implementation of the Provo River Scenic Byway and Watershed Management Plan. This effort includes, but is not limited to, partnering with other Provo River watershed interests to accomplish the following:
    a. establishing a comprehensive data base (including resource maps and water quality data) for the Provo River and its tributaries;
    b. assisting in data analysis to identify trends and water quality issues;
    c. establishing water quality standards and associated monitoring schedules;
    d. identifying "best management practices" (BMPs) for Provo River watershed activities and land uses;
    e. developing appropriate mitigation measures for existing/potential water quality impacts;
    f. developing ordinances to ensure compliance with water quality protection

measures and objectives; and

g. encouraging periodic reviews of the plan and associated objectives to evaluate progress and revise as appropriate.

[Insert Trails Map]

3

WATERSHED CHARACTERISTICS AND USES

CHAPTER 3

WATERSHED CHARACTERISTICS & USES

WATERSHED CHARACTERISTICS AND USES

The seven major canyons included in the Sandy City Watershed Plan area contain unique physical, hydrologic, and environmental characteristics. Along with differing physical and environmental characteristics, the canyons also differ in the types and amounts of use they receive.

It appears that use and recreation in the watershed area is increasing rapidly to coincide with population growth. In order to protect and preserve this precious resource, it is an important time to plan for resource management and future development.

Despite increased usage in watershed areas, canyon water quality is generally excellent, especially for culinary purposes. Based on the experience of other watersheds, there may be cause for concern over biological contamination. Therefore, water quality monitoring in these canyons is important.

Utilizing information from the 1982 *Salt Lake County Area-wide Water Study* and County Tax Records, this chapter describes the characteristics and associated uses of each canyon within the Sandy City watershed area. It also catalogs the land ownership patterns throughout the watershed area.

LAND OWNERSHIP IN THE SANDY CITY WATERSHED

Land ownership in the Sandy City Watershed Management Plan area is divided between private and public entities. The federal government (United States Forest Service) and local governments (Sandy City & Salt Lake City) have ownership of large portions of the land. Additionally, there is private land ownership throughout the watershed. Some of the largest land owners include irrigation companies and drinking water providers like Water Pro and Jordan Valley Water Conservancy District. A map showing watershed land ownership may be found on page 3-11. The following table approximates land ownership acreage and percentages:

SANDY CITY WATERSHED MANAGEMENT PLAN
AREA-WIDE LAND OWNERSHIP

Owner	*Acreage*	*Percentage*
Federal Government	**17,771 acres**	**79 %**
Local Government	**777 acres**	**3 %**
Private	**4,037 acres**	**18 %**
Total	**22,585 acres**	**100 %**

Canyon by Canyon Characteristics & Uses

The identified Sandy City watershed land area included within the seven canyons east of the City is approximately 22,585 acres or 35 square miles. Water from the canyons is being treated, or proposed to be treated, by various entities including the Metropolitan Water District of Salt Lake & Sandy, Water Pro, and Jordan Valley Water Conservancy District. The canyons are generally steep, narrow drainages. With the exception of Little Cottonwood Canyon, these drainages are only accessible by trail. Impacts on the watershed from development and increased use are a concern. Increasing population has pushed more people into these canyons and usage is increasing dramatically. Federal and local governments are recognizing their responsibility to protect the canyons as a water resource and striving to attain a balance of uses. Establishing such a balance means trying to match the social and ecologically acceptable levels of development with public needs and desires. The scope of this document calls for viewing the canyons from the perspective of protecting Sandy City's water resources for the foreseeable future. A map showing watershed hydrology can be found on page 3-13.

A. Little Cottonwood Canyon

Physical and Hydrologic Conditions: Little Cottonwood Canyon includes approximately 17,536 acres (or about 78%) of the identified Sandy and Salt Lake City watersheds with elevations ranging from 5,040 to 11,489 feet. Little Cottonwood Canyon is the steepest and highest canyon in the plan area. The canyon is "U" shaped with rugged side-canyons formed by glaciation. The head waters for Little Cottonwood Creek originate in the Albion Basin, from minor drainages and Cecret Lake. Tributaries to the drainage include the streams from White Pine Reservoir, Red Pine Lake, Hogum Fork, and Coal Pit Gulch. The length of the primary stream channel is approximately 12 miles.

Little Cottonwood Creek peaks late in the spring, June 4 on the average, mainly because of the heavy snow pack in the higher elevations. Throughout the year the stream flow radically fluctuates due to the steep side slopes and impervious rock surfaces that make up much of the canyon. The average annual yield for the stream is 46,149 acre-feet, the largest yield in the plan area.

The canyon contains three reservoirs (Cecret Lake, Red Pine Lake, and White Pine Lake), water distribution and waste-water collection systems for Alta and Snowbird resorts, the Metropolitan Water District of Salt Lake City & Sandy's Little Cottonwood Water Treatment Plant, a hydroelectric power generation plant, and several irrigation ditch diversions.

There are diversion structures located along Little Cottonwood Creek at Murray Penstock, one mile up the canyon, and at the Radial Gate diversion below Wasatch Blvd. The Metropolitan Water District of Salt Lake & Sandy is the primary consumer of Little Cottonwood Creek water and operates a treatment plant at the mouth of the canyon. *(See Hydrology Map on page 3-13.)*

Canyon Uses: Uses in Little Cottonwood Canyon are characterized by heavy developed and dispersed recreational use, destination lodging, and transportation. All uses in the canyon have increased during the past decade. Downhill skiing is the most intensely developed recreation use in the canyon at Alta and Snowbird ski resorts. The most accurate measure of growth in the canyon is average daily traffic. In 1987, according to the Utah Department of Transportation and Salt Lake County Parks & Recreation, the average daily traffic was 12,865 vehicles. In 1996, the average daily traffic had increased to 16,540 vehicles, an increase of 29 percent.

Developed campsites are maintained by the Forest Service at Tanner Flat and Albion Basin. Use at these sites has varied from year to year. The two campgrounds have a combined capacity of approximately 465 persons. While weekend and holiday user numbers are high, weekly averages fall below capacity.

Land Ownership: Little Cottonwood Canyon is predominantly under Forest Service management. Private ownership, however, does exist at the canyon mouth,

Wasatch Resort, Snowbird Ski Resort, the Town of Alta, and in various mining patents. Several land exchanges involving Salt Lake City, the Forest Service, Trust for Public Lands, The Nature Conservancy, and private land owners have altered the land ownership pattern in Little Cottonwood by placing more private property in public ownership. The following tables describe current land ownership in Lower and Upper Little Cottonwood Canyon. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
LOWER LITTLE COTTONWOOD CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**494 acres**	**55 %**
Local Government	**48 acres**	**5 %**
Private	**361 acres**	**40 %**
Total	**903 acres**	**100 %**

LAND OWNERSHIP
UPPER LITTLE COTTONWOOD CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**13,359 acres**	**81 %**
Local Government	**408 acres**	**2 %**
Private	**2,866 acres**	**17 %**
Total	**16,633 acres**	**100 %**

B. Bell Canyon

Physical and Hydrologic Conditions: Bell Canyon includes approximately 1,515 acres (or roughly 7%) of the identified Sandy City watershed with elevations ranging from 5,160 to 11,250 feet. The canyon's slopes are very steep.

Surface waters in the canyon originate in the Lone Peak Wilderness and have a 6288 acre-feet average annual yield, the highest in the plan area after Little Cottonwood. Snow melt is the origin of the creek. The average peak flow occurs on June 8. The length of the primary stream channel is approximately 5 miles.

There is one active water retention reservoir in Bell Canyon. Upper Bell Canyon Reservoir, constructed in the late 1800s, held 220 acre-feet of water and was located at the elevation of 9,400 feet. Upper Bell Canyon Reservoir dam was breached in the 1950's due to safety concerns. Lower Bell Canyon Reservoir, located directly above current development in the foothills of Sandy at approximately 5,578 feet elevation originally held 420 acre-feet of water. In the early 1990's, the capacity of the reservoir was reduced to approximately 30 acre-feet due to dam safety concerns. In addition to these reservoirs, there are two diversion structures making use of Bell Canyon water. These structures are located above and below lower Bell Canyon reservoir. *(See Hydrology Map on page 3-13.)*

Canyon Uses: This is a high-use canyon. Bell Canyon is used for a variety of recreational purposes. The lower portion of the canyon, up to the waterfalls, is a popular hiking, picnicking, and camping destination. Climbers can access the Bell Canyon Towers for day-climbing excursions and overnight climbing adventures are common in the Lone Peak cirque in the Forest Service-managed Lone Peak Wilderness Area.

Land Ownership: Sandy City and the Forest Service are the main land owners in Bell Canyon. The following table provides details about the land ownership pattern existing in Bell Canyon. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
BELL CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**1,306 acres**	**86 %**
Local Government	**173 acres**	**11 %**
Private	**36 acres**	**3 %**
Total	**1,515 acres**	**100 %**

C. Middle Fork & South Fork of Dry Creek Canyon

Physical and Hydrologic Conditions: Middle Fork and South Fork of Dry Creek Canyon encompass approximately 1,282 acres (or about 6%) of the identified Sandy City watershed. Both forks contain very steep terrain. Elevation ranges from 5,160 to 10,260 feet.

Headwaters of South Fork and Middle Fork Creeks originate primarily from snow melt. The area receives on average 20 to 30 inches of precipitation a year. The average annual yield is approximately 1,700 acre-feet. Peak flow dates are typically in June. The combined length of the primary stream channels is approximately 5 miles.

Water from the Canyon(s) is treated at the Water Pro Treatment Plant and the Jordan Valley Water Conservancy District's Southeast Regional Water Treatment Plant. It is then delivered to residents of Sandy and Draper. A diversion structure at the mouth of the canyon directs water to the water treatment plants. *(See Hydrology Map on page 3-13.)*

Canyon Uses: There is very little recreational activity in these canyons. Despite the current low level of use, there is potential for this canyon to receive dramatic increased use with the development of residential areas at the mouth of the canyon. There are primitive trails that access South Fork. South Fork is also the location of a Sandy City water tank site.

Land Ownership: In these canyons, the lower canyon has some private land ownership, while the upper canyons are predominantly controlled by the Forest Service. The following table shows land ownership details. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
MIDDLE FORK & SOUTH FORK OF DRY CREEK CANYON
(Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**915 acres**	**71 %**
Local Government	**131 acres**	**11 %**
Private	**236 acres**	**18 %**
Total	**1,282 acres**	**100 %**

D. Rocky Mouth Canyon

Physical and Hydrologic Conditions: Rocky Mouth Canyon includes approximately 496 acres (or roughly 2%) of the identified Sandy City watershed. Elevations range from 5,160 feet to 10,260 feet. It is a steep canyon. Normal annual precipitation in this canyon is 20 to 30 inches. Peak flows occur in June. Annual yield estimates are approximately 650 acre-feet. The length of the primary stream channel is approximately 2.5 miles.

The Rocky Mouth stream is diverted to commingle with Big Willow Creek. Collectively, these waters are delivered to the Water Pro and Jordan Valley Water Conservancy District treatment plants. *(See Hydrology Map on page 3-13.)*

Canyon Uses: Recreation use is heavy and concentrated primarily within the falls trail corridor approximately ½ mile up the canyon. There are no existing recreational facilities except for a high-use trail to a picturesque waterfall a short way up the canyon.

Land Ownership: Land ownership in Rocky Mouth is split between private land owners (located at the lower end of the canyon) and the federal government. This relationship is detailed further in the following table. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
ROCKY MOUTH CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**482 acres**	**97 %**
Local Government	**0 acres**	**0 %**
Private	**14 acres**	**3 %**
Total	**496 acres**	**100 %**

E. Big Willow Canyon

Physical and Hydrologic Conditions: Big Willow Canyon encompasses approximately 943 acres (or roughly 4%) of the identified Sandy City watershed. Headwaters for Big Willow Creek begin at over 10,800 feet elevation. Half of the drainage area lies above 8,000 feet. This canyon usually receives between 20 to 40 inches of precipitation a year. Surface waters have an average peak flow in the first weeks of June. The stream has an average annual yield of just under 1,500 acre-feet. The length of the primary stream channel is approximately 4.25 miles.

There are several diversion structures in Big Willow Canyon that are operated by Water Pro. They are located at the mouth of the canyon. Water is diverted to be treated at the Water Pro and Jordan Valley Water Conservancy District treatment plants. *(See Hydrology Map on page 3-13.)*

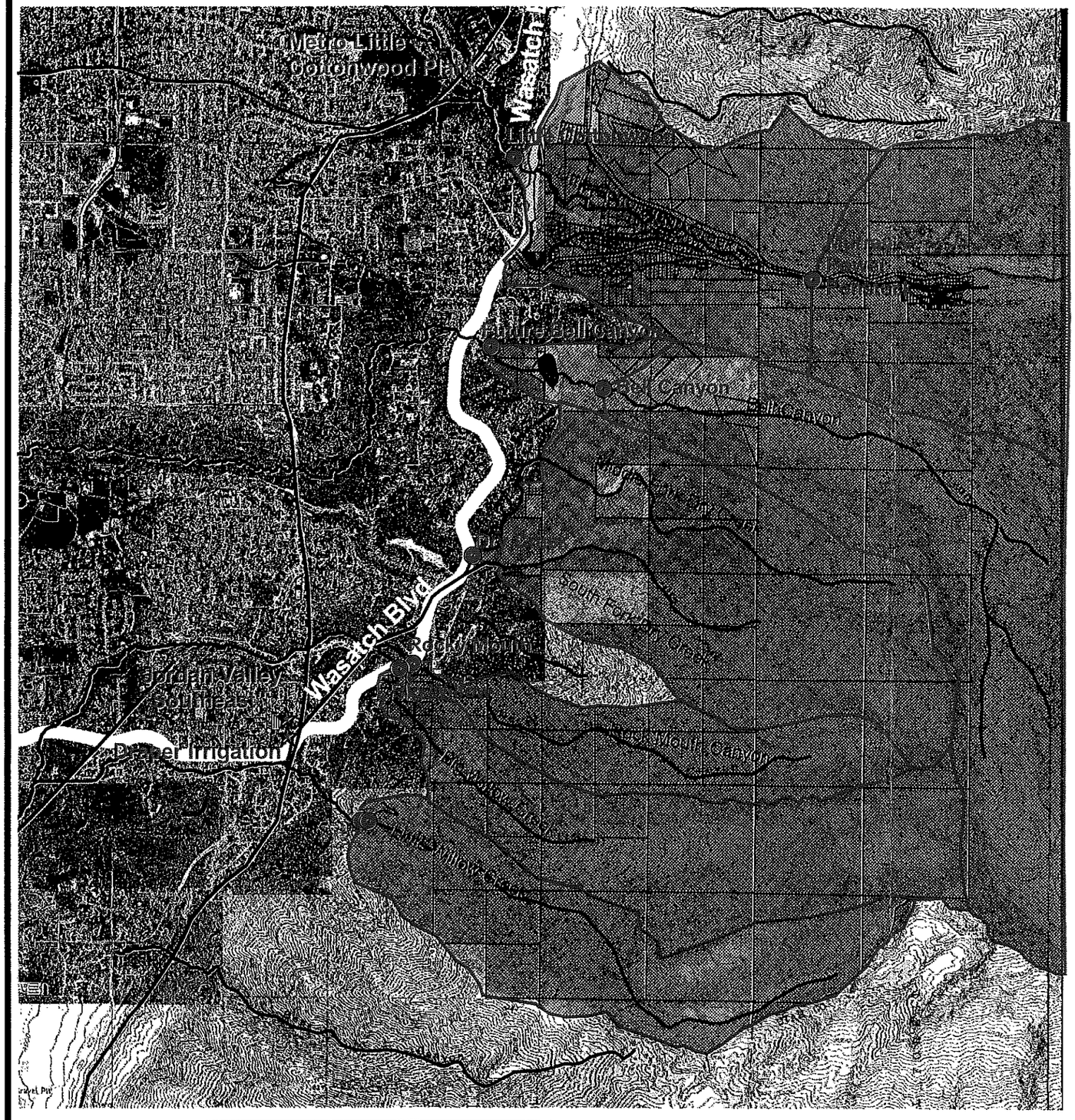
Canyon Uses: There is little recreational usage within Big Willow Canyon. One main trail accesses the canyon. This trail begins at Hidden Valley Park and follows a relatively steep path up the canyon. A horse trail is located on the ridge between Big Willow and Little Willow Canyons.

Land Ownership: Water Pro is a significant private land owner in this canyon. Other lands are owned primarily by the federal government and managed by the Forest Service. The following table outlines this land ownership. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
BIG WILLOW CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**714 acres**	**76 %**
Local Government	**0 acres**	**0 %**
Private	**229 acres**	**24 %**
Total	**943 acres**	**100 %**

Sandy City Watershed Ownership



Legend

Ownership

- Private
- Federal
- Local Agency
- Watershed Boundary
- Diversions
- Treatment Plants
- Waterways

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STATE OF UTAH

Date: 4/02/2001

Sandy City Watershed Hydrology Map

Legend

Watershed

- Upper Little Cottonwood
- Lower Little Cottonwood
- Upper Bell Canyon
- Lower Bell Canyon
- Dry Creek / Middle/So Fork
- Rocky Mouth
- Big Willow
- Little Willow
- Treatment Plants
- Diversions
- Waterways

Note: The following diversions are diverted to the Little Cottonwood Water Treatment Plant: Little Cottonwood, Murray Power Penstock, and the Future Bell Canyon diversion. Bell Canyon, Dry Creek, Rocky Mouth, and Big Willow are diverted to the Jordan Valley Southeast Regional Water Treatment Plant.

N

SANDY CITY
1893
STATE OF UTAH

Date: 4/02/2001

F. Little Willow Canyon

Physical and Hydrologic Conditions: Little Willow Canyon includes approximately 813 acres (or roughly 4%) of the identified Sandy City watershed. Canyon elevations range from 5,140 feet to over 10,700 feet. The stream channel is approximately 3.15 miles long and very steep. Little Willow Canyon has an annual water yield of approximately 1,200 acre-feet. The average peak flow occurs in the first part of June.

There are two diversion structures in Little Willow Canyon. They are operated by the Utah State Prison in Bluffdale, the Little Willow Irrigation Company, and the Hidden Valley Golf Course. Currently, the water is utilized for non-culinary purposes. In the future, this water may be treated and used for culinary purposes. *(See Hydrology Map on page 3-13.)*

Canyon Uses: Little Willow sees moderate pressure from recreationalists due to its close proximity to Hidden Valley Park. There are observable impacts from dogs at and near the canyon mouth.

Land Ownership: Little Willow is the domain of private land owners and the federal government in the upper reaches of the canyon. The following table shows land owner acreage and percentages. *(See Land Ownership Map on page 3-11.)*

LAND OWNERSHIP
LITTLE WILLOW CANYON (Watershed Area)

Owner	*Acreage*	*Percentage*
Federal Government	**501 acres**	**62 %**
Local Government	**17 acres**	**2 %**
Private	**295 acres**	**36 %**
Total	**813 acres**	**100 %**

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[Insert Ownership Map]

[Insert Hydrology Map]

4

WATERSHED JURISDICTION

CHAPTER 4

WATERSHED JURISDICTION

WATERSHED JURISDICTION

Many entities share jurisdiction over the lands that make up the Sandy City Watershed. This chapter summarizes the responsibilities of major jurisdictions involved in managing the watershed.

A. SANDY CITY WATERSHED AUTHORITY

Sandy City's authority for watershed protection is granted by the Utah Constitution, Utah Statutes, and United States Statutes. The preparation of this document, the 2002 Watershed Management Plan, is another step in carrying out this mandate from federal and state authorities.

1. Utah Constitution

Utah Constitution (Article XI, Section 5), authorizes the state legislature, by general laws, to classify cities in proportion to population. This constitutional provision has been implemented by state legislation to grant authority over watersheds based on this classification system. The Utah Constitution also specifically addresses the authority of municipalities to own and develop water rights. Municipal corporations are forbidden from directly selling, leasing, alienating or disposing of any waterworks, water rights or sources of water supply. Cities are further directed to preserve, maintain, and operate their water rights, waterworks, and water sources in order to supply water to their inhabitants at reasonable rates. Municipal water rights, however, may be exchanged for other water rights (Utah Constitution, Article XI, Section 6). The prohibition against alienating city water rights (except by exchange) prevents Sandy City from selling or leasing its water rights to public and private water users in the Wasatch Canyons.

Sandy City owns water rights in Little Cottonwood and Bell canyons. Little Cottonwood Canyon and Bell Canyon are primary and future sources of Sandy water. Water is treated at the Metropolitan Water District of Salt Lake & Sandy's Little Cottonwood Water Treatment Plant, Water Pro's Treatment Plant, and Jordan Valley Water Conservancy District's Southeast Regional Water Treatment Plant.

Water Pro and the Jordan Valley Water Conservancy District own water rights in all the mentioned canyons except Little Cottonwood. Salt Lake City, Sandy City, and others own water rights in Little Cottonwood Canyon.

2. State Legislation

The Utah State Legislature has implemented the classification authority granted by the Utah Constitution by dividing municipal corporations into three classes. First Class Cities are municipalities with more than 100,000 people (Utah Code Annotated, 10-1-1). These classifications have been upheld by the Utah Supreme Court (*Salt Lake City V. Salt Lake County*, 1922. 60 U. 423, 209 P. 207).

Cities are granted extraterritorial jurisdiction for the construction, operation, and maintenance of waterworks, and to protect the water from pollution that is "used in and necessary for" city waterworks. Protection of water from pollution for all classifications of cities is explicitly recognized "for 15 miles above the point from which it is taken, and for a distance of 300 feet on each side of such streams" (Utah Code Annotated, 10-8-15).

Additional watershed protection jurisdictions for cities of the First Class, like Sandy City, extend further than other classifications of cities to include protection of the "entire watershed" (Utah Code Annotated, 10-8-15). Therefore, Sandy City is granted management responsibility, anywhere in the canyon watersheds where Sandy City obtains its water supply, to protect canyon waters from activities that are detrimental to water quality or quantity. Cities may enact any ordinances necessary to protect the watershed, "and are authorized and empowered to enact ordinances preventing pollution or contamination of the streams or watercourses in which the inhabitants of the cities derive their water supply" (Utah Code Ann., 10-8-15).

Pursuant to general eminent domain authority in the Utah Constitution, Sandy City may condemn private property for public use with just compensation (Utah Constitution, Article I, Section 22). Specific statutory authority to acquire water, waterworks, and "property connected therewith," including the power of condemnation for such purposes, has been granted to cities by the Utah Legislature (Utah Code Ann., 10-7-4). The Utah statutes granting extraterritorial jurisdiction to cities over watersheds are broad and give the cities substantial discretion in the management of watersheds to protect water sources. As a First Class City, Sandy City has special powers over entire watershed areas.

B. Existing Sandy City Policies/Ordinances

Existing Sandy City land use development policies and practices are reflected through the City's Land Development Code. These ordinances apply to all properties within the jurisdictional boundaries of Sandy City.
Due to the City's extraterritorial jurisdictional rights to protect its watershed resources, watershed management ordinances adopted by the City apply to all areas within the City's identified watershed boundaries.

Although the City currently has not adopted specific watershed protection ordinances, several of the City's existing land use regulations complement the community's watershed management objectives. A summary of the City's applicable land use and development ordinances and regulations may be found in Appendix D.

C. Existing Salt Lake City Policies and Ordinances

Salt Lake City has been very involved in watershed protection and management over the course of the past century. Sandy will continue to work with Salt Lake City toward mutual watershed objectives and improvements.

1. Salt Lake City Watershed Ordinance

Salt Lake City has implemented state statutory authority for watershed protection through the adoption of ordinances. The Salt Lake City Watershed Ordinances may be found under Title 17 of the Salt Lake City Code. Title 17 addresses all ordinances under the jurisdiction of Salt Lake City Department of Public Utilities. Chapter 17.04 contains ordinances for Salt Lake City's watershed areas (including Little Cottonwood Canyon, which it shares with Sandy City). The Public Utilities Director is the general supervisor of all city water and watershed related activities.

a. Article II regulates subdivisions including: construction approval (17.04.070), waste disposal requirements (17.04.080), plans (17.04.090), and sale of lots prior to construction approval (17.04.110).
b. Article III regulates livestock and other animals within the watershed. This article contains the dog permit requirements (17.04.160) and the prohibition of livestock near streams (17.04.130).
c. Article IV governs water use and sanitary facilities. Some of the specific items contained in Article IV include rules and regulations (17.04.180), sanitary sewage disposal system requirements (17.04.210), garbage or human waste disposal - permit required (17.04.230), chemical toilets or privies (17.04.250), hauling of human waste required (17.04.280), and prohibited locations of toilet vaults (17.04.290).
d. Article V regulates water pollution and other unlawful activities. Some of the specific items contained in Article V include nuisances prohibited (17.04.310), pollution of canyon waters prohibited (17.04.320), prohibited acts (17.04.330), camping and campfire restrictions (17.04.340), and garbage deposit prohibited (17.04.350).
e. Article VI governs enforcement issues in the watershed (except for areas within the Town of Alta at the top of Little Cottonwood Canyon). Section 17.04.380 addresses interfering with officers. Section 17.04.400 addresses trespassing in the watershed. Article VII regulates the appropriations of water and Article VIII regulates the adoption of public law.

An additional ordinance update is currently in the adoption process

regarding herbicides and pesticides.

D. Salt Lake County Land-Use Controls

Salt Lake County has primary land-use control jurisdiction in the canyons over private lands. Through the administration of planning, zoning, and coordination of an interagency site development plan approval process, the county balances development and protection of the canyons. The Salt Lake County Public Works Department and more specifically the Planning and Development Services division has the primary administrative role regarding land-use. The planning/development services division is responsible for the preparation of general plans to guide public and private development and for preparation of amendments to the zoning ordinance. The county zoning ordinance is periodically revisited in order to better reflect changing conditions. The division also maintains development standards to insure uniform quality of design and construction.

According to the division, the uniformity, consistency, and quality of design of private development in the county is a direct reflection of the site design and development standards adopted by and enforced by the county. In an attempt to maximize the potential benefits of these standards, the county administers a comprehensive site plan review and approval process. That process incorporates input from both county and non-county (e.g. municipal, state, federal) agency representatives and authorities pertinent to the proposed development of property under consideration. A broad range of issues (culinary water, effluent disposal, natural hazards, urban hydrology, excavation, grading, resource protection, site planning, engineering, traffic management, etc.) are customarily addressed in this process. Oft-times, modification of submitted development proposals, as necessary to ensure compliance with adopted ordinances, standards, and procedures, is the objective of the county's site plan review and approval process. The same applies to building and related construction code compliance requirements.

At the beginning of a proposed project, builders, and developers meet with staff members to coordinate the requirements of their projects. These staff members coordinate the engineering review of plans and administer the issuance of building permits. After a permit is issued, planning/development services has the responsibility to inspect structures for compliance with building codes.

1. Zoning

Salt Lake County canyon zoning was first implemented in 1973 with the establishment of forestry zones. Previously, applicants for canyon developments only had to comply with the existing building code and the health department requirements. Designations of forestry zones include: F-1, FR-0.5, 1, 5, 10, 20, and FM - 10 and 20. The F-1 zone is not less than 20,000 square feet and is limited to single family dwelling. The numbers in each FR zone designate the minimum lot size in acres. The numbers included in each FM zone designate units per acre allowed (twice the number of guest rooms are permitted).

All the canyons in the watershed are included in the Foothill Canyon Overlay (except for the area within the Town of Alta at the top of Little Cottonwood Canyon). The C2ZC zone is specified for commercial development based on a conditional use which is subject to review by the planning commission.

Revised Sensitive Lands Protection Regulations were adopted by Salt Lake County on January 21, 1998. The Foothills and Canyons Overlay Zone was revised to include the following watershed-related concerns.

a. First, the stream set-back for new buildings was extended from 50 to 100 feet. This new regulation will strengthen current watershed protection measures already in place.

b. The second significant change involved site development. A new standard was developed called "limits of disturbance," which specifies an area that construction and development activity must be contained. This new standard, located in the "Foothills and Canyons Overlay Zone," formerly the "Hillside Protection Zone," will decrease the amount of lands that are disturbed through accidental or uninformed construction practices.

Conditional uses are also outlined in the zoning ordinance. These are special uses that are more intensive than the permitted uses under a given zoning classification. These uses require a site specific review and recommendations by the planning commission. Examples of conditional uses are the limited commercial developments that have occurred in the Wasatch Canyons in forestry zones.

As necessary, Planning Commission recommendations are subject to inter-agency review. The Planning Commission in turn requests recommendations from the following: development services, engineering, hydrology, fire department, traffic engineer, Salt Lake Valley Health Department, building inspector, U.S. Forest Service, environmental health, Sandy City Department of Public Utilities, Sandy City Planning Division, Utah Department of Transportation, Sheriff's department, and cities within a half-mile of the proposed development. Sandy City Department of Public Utilities is usually asked for a recommendation in cases where water service for a property is questioned. Decisions concerning watershed protection are made by the Forest Service and Sandy City Public Utilities Department. Any agency involved in the recommendation process may request additional information from the developer.

2. Site Plan Approval

Site plan approvals for permitted uses are processed through the Salt Lake County planning/development services division. Permitted uses, which are outlined in the zoning ordinance, can be approved by the planning/development services staff without a recommendation by the planning commission. The developer is required to meet the criteria set forth in the zoning ordinance to

receive final approval. For sensitive canyon developments, the planning/development services staff may request additional recommendations from the Salt Lake County Planning Commission.

E. Salt Lake Valley Health Department

The Salt Lake Valley Health Department (Health Department) can play an important role in watershed management. The Health Department is created by state statute to serve as a regional health agency for all valley local governments. With representation from the local government, the Health Department acts as a policy-making body. Under Section 26-24-20, Utah Code annotated, 1953, the Health Department prescribes its own health regulations for watersheds (Salt Lake Valley Health Department Regulation #14, Watersheds). These regulations seek to prevent damage to property, the spread of disease, the creation of nuisances, and air and water pollution. The regulations establish standards for setbacks from water sources, animal use, waste disposal systems, and water supply certification.

The Health Department reviews specifications, reports, and plans for development proposals before a building permit is issued by the Salt Lake County Planning/Development Services Division. Inspections, including sampling and analysis of soil and water, on public and private property are authorized in the watersheds to verify compliance with regulations. Reviews and comments are made on proposed contracts or agreements between any district, city, county, government or person for the use or occupancy of watersheds within Salt Lake County. The Health Department administers necessary watershed regulation enforcement activities. The governor and the Environmental Protection Agency (EPA) have designated the Health Department as the area-wide water quality management agency. Under this designation, the Health Department is also responsible for the implementation of some federal water quality programs. Additionally, the Health Department is required to approve all septic systems in canyon areas.

F. United States Forest Service

The Forest Service (USFS) is the largest land manager in the plan area. United States lands were reserved from the public domain for the establishment of the Wasatch-Cache National Forest in 1904. Forest Service management is directed by several statutes dictating multiple-use management.

1. Forest Management and Planning

The 1985 Wasatch-Cache National Forest Land and Resource Management Plan directs the activities of the Forest Service within the plan area. The Forest Service's planning and management activities in the plan area are oriented primarily to watershed management, developed and dispersed recreation, wilderness areas, and grazing. The Forest Service is a major provider of developed and dispersed recreation in the plan area for local residents and visitors. The Wasatch-Cache National Forest leads the nation in visitor days for any National Forest. A substantial amount of these visits were made to the Wasatch Canyons. The close proximity of the Wasatch-Cache National Forest

has made it a favorite local choice for family and individual recreation activities.

Ski resorts on National Forest System lands are a major provider of recreation. Alta and Snowbird, in Little Cottonwood Canyon, are dependent on Forest Service special-use permits for the majority of their development. The Forest Service issues and manages special-use permits for existing private recreation residences on National Forest System lands. Currently, the Forest Service directs residential development to private lands only, but still honors existing permits. These residences are under strict permits administration by the Forest Service for house-addition permits and other on-site activities, including gardening and landscaping. The Forest Service provides trail heads and parking facilities for summer and winter dispersed recreation. A wide variety of dispersed recreation activities take place on these lands including hiking, cross country skiing, fishing, hunting, backpacking, and nature study. The Forest Service operates and maintains picnic and camping facilities in Little Cottonwood Canyon.

Under the provisions of the Endangered American Wilderness Act of 1978, the Lone Peak Wilderness Area was created. Lone Peak is located between Little Cottonwood and American Fork Canyons. Under the goal of protecting the watershed resource, the Forest Service is committed to conducting water quality analysis in wilderness areas on municipal watersheds and to enforce a prohibition of camping within 200 feet of any water source in Little Cottonwood Canyon.

The 1985 Wasatch-Cache National Forest Land and Resource Management Plan established the goal to protect the watershed in order to successfully accomplish Forest Service programs mandated by congressional actions and executive orders. Under the provisions of the Organic Administration Act (1897), the Forest Service is charged with "securing favorable conditions of water flows." This language has been interpreted by Forest Service hydrologists as the minimum stream flows necessary to provide for the self-maintenance of stream systems.

The Forest Service Channel Maintenance Program is intended to secure rising and receding flows, which produces a smooth transition between peak and base flows. This circumvents flood discharges and minimizes channel erosion and sediment deposition associated with instability or disequilibrium conditions. Flow maintenance is further intended to reduce the threat of channel aggregation, channel erosion, flood plain encroachment, vegetation encroachment, changes in hydrologic geometry, and channel capacity.

The channel maintenance program will establish a regime of flow requirements representing the rising and falling limb of the natural stream hydrograph from base flow to bank full in the spring and again from bank full to base flow after peak flows occur. Flows necessary to maintain channel capacity have been

quantified for Little Cottonwood and have been filed as part of the Utah Lake-Jordan River water rights adjudication. An update of the Forest Service Plan is in progress.

2. Coordination with Salt Lake City

Under the provisions of federal statutes and regulations, the Forest Service plays a special role in the management of Salt Lake City's municipal watersheds. In order to protect the water supplies for Salt Lake City, the Forest Service has entered into formal agreements with authorized cities to restrict the use of U.S. Forest Service land from which the water supplies are derived, when necessary. In 1981, the Wasatch-Cache National Forest, U.S. Department of Agriculture, and Salt Lake City Corporation prepared a Memorandum of Understanding (MOU) to carry out these federal mandates.

The MOU cites the congressional acts that recognize Salt Lake City's extraterritorial jurisdiction in the watershed and the need to prevent the contamination of streams or water courses from which the City inhabitants derive their water supply. The MOU also outlines responsibilities for the Forest Service including coordination with the city for any federal land-use planning in the watersheds, authorization of improvements needed by the city to protect and develop water, consultation with the City for any Forest Service water development, and assurances for the provision of necessary services such as garbage collections and maintenance of sanitary facilities.

Under the provisions of the MOU, the City is authorized to provide the Forest Service with water to supply recreation and administrative sites, and to assume management responsibilities for recreation and sanitation facilities in City Creek, Mountain Dell, Parleys, and Lambs Canyons. Joint activities are outlined by the MOU including: cooperation on toilet pumping at recreation sites, cooperation in law enforcement, land acquisition for ownership consolidation, information sharing, reviews of all land transactions, and the preparation of a specific watershed management strategies plan.

It is possible for Sandy City to pursue a similar MOU with the United States Forest Service.

G. Metropolitan Water District of Salt Lake & Sandy

The Metropolitan Water District of Salt Lake & Sandy (MWDSLS) is comprised of Salt Lake City and Sandy City. Sandy City applied for annexation into MWDSLS in 1990 and the Board of Directors unanimously approved their annexation petition. MWDSLS was first created after the prolonged drought of 1934 by the Salt Lake City Commission to provide a long-range water supply for Salt Lake City. The boundaries of the district are conterminous with the boundaries of its member cities. Through taxing capability, MWDSLS gives Salt Lake City and Sandy City the ability to provide alternative means of financing large-scale water projects that

would otherwise exceed the City's constitutional debt limitation. Development of Deer Creek Reservoir as a water supply, and MWDSLS becoming a principal stockholder in the Provo River Water Users' Association in the 1940s, was the main catalyst for creation of the district. Since 1935, MWDSLS has assumed the lead role for supplying water to Salt Lake City and subsequently to Sandy City. MWDSLS projects include Deer Creek Reservoir, Little Dell Reservoir, and the Little Cottonwood Water Treatment Plant.

Salt Lake City, Sandy City, and MWDSLS have enjoyed close cooperation and conjunctive management. MWDSLS Board of Trustees is appointed by the city councils of each city. Salt Lake City appoints five board members and Sandy City appoints two board members, which comprise the seven-member Board of Trustees. MWDSLS, by statute, provides water to Salt Lake City and Sandy City on a preferential right basis at rates fixed by the District. Surplus water is sold to other water distributors in Salt Lake County, principally the Jordan Valley Water Conservancy District. MWDSLS also owns water rights for Little Dell Reservoir in Parleys Canyon.

H. Town of Alta

Alta is an incorporated municipality in the upper reaches of Little Cottonwood Canyon that includes the Albion Basin. Within its boundaries, Alta exercises land-use jurisdiction by maintaining planning and zoning controls, public safety standards, and an enforcement apparatus. It uses Salt Lake City water through a surplus water contract. Alta has displayed concern over watershed impacts in Little Cottonwood Canyon. Existing standards and measures developed by Salt Lake City for watershed protection are applicable in the Town of Alta. As a result of the Salt Lake City planning effort, the Town of Alta has adopted regulations about the shared watershed that are in line with Sandy's plan. Sandy will seek to encourage the Town of Alta to maintain current watershed regulations.

I. Jordan Valley Water Conservancy District

The Jordan Valley Water Conservancy District (JVWCD) plays an important role in Salt Lake Valley water issues and owns some water rights in the plan area. JVWCD serves as the primary water distributor to many of the communities in the south and west portions of the Salt Lake Valley.

J. Other Federal and State Agencies

Several other federal and state governmental agencies play indirect roles in the Wasatch Canyons under review in this plan. The United States Environmental Protection Agency (EPA) is responsible for administering two important statutes affecting the watersheds: the Clean Water Act and the Safe Drinking Water Act. These two acts are representative of primacy legislation. States, upon approval of programs consistent with the statutes, are given principal responsibility for implementing the provisions of the acts.

The Sate of Utah, through the Department of Environmental Quality (DEQ), has primacy over the implementation of the Clean Water Act and the Safe Drinking Water Act. DEQ has established the state water standards that the Health Department and the Division of Drinking Water administer in community watersheds. The provisions of the Clean Water Act most applicable to the plan area are the anti-degradation standards. The anti-degradation standards seek to protect classified pristine waters from water quality degradation. Under the provisions of Section 319 of the Clean Water Act, no new point sources, treated or otherwise, are allowed to enter into designated streams or any contributing drainage.

With passage of the Water Quality Act of 1987, states were given additional support and direction for comprehensive implementation of non-point source controls statewide and in local jurisdictions. Programs include monitoring the effects of recharging urban runoff into groundwater. It would be expensive and difficult, due to the nature of the subsurface materials, to implement a monitoring system to assess the effects of existing non-point discharges in the canyons. All of the streams in the plan area are classified for anti-degradation protection. The streams in the defined watershed area fall under one or more of the following classifications: Class 1C, Class 2B, or Class 3A. Class 1C is protected for use as a raw water source for domestic water systems, with prior treatment by standard complete treatment processes as required by the Utah State Division of Environmental Quality. Class 2B is protected for in-stream recreational use and aesthetics such as boating, water skiing, and similar uses except for swimming. Class 3A is protected for in-stream use by beneficial aquatic wildlife including species of game fish and cold water aquatic life and aquatic organisms necessary in their food chain.

- Little Cottonwood Creek and its tributaries have been classified 1C, 2B, and 3A.
- Bell Canyon Creek and its tributaries have been classified 1C, 2B, and 3A.
- Middle Fork/South Fork Canyon Creeks and their tributaries have been classified as 1C, 2B, and 3A.
- Rocky Mouth Canyon Creek and its tributaries have not been classified under R317-2.
- Big Willow Canyon Creek and its tributaries have been classified 1C, 2B, and 3A.
- Little Willow Canyon Creek and its tributaries have been classified 1C, 2B, and 3A.

The Safe Drinking Water Act, as amended in 1986, establishes drinking water standards for the nation. The Act and its implementing regulations establish limits and monitoring requirements for several constituents to assure that drinking water supplies are maintained in healthful conditions. The U.S. Army Corps of Engineers is responsible for carrying out Section 404 of the Clean Water Act, which regulates dredging and filling wetlands. Any stream alteration, dredging, or wetland filling, requires a 404 permit from the Corps. This permitting process helps control erosion and activities that could adversely affect stream quality. The Corps also has general flood control responsibility. The Utah State Division of Water Rights also requires a permit for any stream alteration practices.

In addition, the state is implementing a groundwater protection strategy to protect Utah's groundwater supplies from contamination. Within the State Division of Water Rights, the State Engineer is responsible for water rights issues within the watershed.

Other entities are involved with or influence watershed management in the Wasatch Canyons. Salt Lake County Service Area #3 provides water and fire protection services at Snowbird and adjacent areas. The Salt Lake County Sheriff enforces watershed ordinances and county land-use ordinances. The Utah Division of Parks and Recreation, through implementation of the Parks and Recreation River Enhancement Program, could develop a program for one or more of the Wasatch Canyon streams in cooperation with other governmental entities. Finally, the Utah Department of Transportation maintains highway responsibilities in Little Cottonwood Canyon.

Other Plans & Issues Relevant to the Watershed Area

A. Wasatch-Cache National Forest Land/Resource Management Plan

The Wasatch-Cache National Forest Land and Resource Management Plan (Forest Service Plan), completed in 1985, is intended to guide all natural resource management activities and establish management standards and guidelines for the Wasatch-Cache National Forest. The Forest Service Plan describes long-term management practices, levels of resource production, and availability of lands for resource management. It contains the overall direction and activities that will be required to achieve the desired condition of the forest and consists of an analysis of the management plan situation, issues, forest management direction, and implementation.

The Final Environmental Impact Statement (FEIS) for the Forest Service Plan selected a preferred plan alternative. In response to public input, this alternative balances market and non-market resources while providing environmental protection. Under this alternative, the Forest Service budget would increase to provide increased resource use, and developed and dispersed recreation, and wilderness uses. Forest resources addressed in the plan include recreation, wilderness, fish and wildlife, range, timber, water, and minerals. Currently, the Forest Service is updating the 1985 Wasatch-Cache Forest Land and Resource Management Plan.

B. Salt Lake City Watershed Management Plan, 1999

Salt Lake City adopted the first Watershed Management Plan in 1988 to maintain high water quality for the future. This plan was updated in 1999. Prior to the update, the watershed was receiving increasing pressures from commercial and residential development and a variety of recreational uses. Visitor numbers increased rapidly throughout the early 1980's and management guidelines were needed to ensure high water quality for the next ten years. The watershed planning

effort involved all the major jurisdictional agencies involved with the watershed, along with affected communities and businesses. The Watershed Management Plan contained the following sections: Watershed Jurisdiction and Ownership, Watershed Physical/Environmental Characteristics, and Policies for Salt Lake City Watershed Management. The Watershed Management Plan has been successful in providing the guidelines and management direction necessary to effectively manage the watershed.

C. Salt Lake County Planning Division Plans and Studies

The Wasatch Canyons Master Plan (Canyons Master Plan) was adopted by Salt Lake County in 1989. The purpose of the plan is to provide clear guidance and coordination of future uses in association with existing resources in the seven major Wasatch Canyons through the year 2010: "The Salt Lake County Wasatch Canyons Master Plan goal is to provide diverse opportunities for public enjoyment of the Wasatch Canyons within the constraints of a limited geographic setting and the capacities of the natural environment to accommodate uses without significantly diminishing either the quality of the canyon resources or the quality of the canyon experience." The Wasatch Canyons plan addresses land-use issues in the plan area. It specifically addresses policies governing various recreational uses, transportation, canyon plans, and general policies. The Canyons Master Plan calls for an update ten years after adoption.

In 1998, Salt Lake County adopted a new set of zoning ordinances aimed at protecting sensitive lands. These new ordinances provide the watershed with increased protection. Items such as stream setbacks for development have been increased from 50 feet to 100 feet. Tighter standards regarding the amount of disturbance allowed to the natural landscape during construction are also included.

D. Town of Alta, General Plan, 1992

The 1992 General Plan for the Town of Alta in Little Cottonwood Canyon provides a comprehensive framework and direction for the use, development and conservation of land and water resources.

In regards to watershed protection and water quality, in the General Plan, the Town of Alta pledges to "support and enforce the policies, regulations and plans" of its partners (namely, Salt Lake City, Sandy City and the Forest Service) in canyon management. The plan stipulates that no further development be allowed in areas not served by the public sewer system. Additionally, the Town recommends that provisions for sanitary facilities and trash receptacles be made to assist hikers and bikers in preserving water quality and following watershed recommendations designed to protect the water resources of the Alta area.

Protection of the watershed is one of the major emphases guiding the plan and serves as the basis for development philosophy. The 1992 plan was scheduled to be revised and adopted in late 2001.

E. Public/Private Land Exchanges

Public land management is hampered in some canyons by the scattered nature of the publicly-owned land holdings. Currently, no exchanges are being discussed. However, Sandy may seek to acquire and exchange more land within the watershed area in order to better manage the water resources.

F. Bell Canyon Purchase

Sandy City purchased the land within Bell Canyon from the Bell Canyon Irrigation Company in order to protect the waters of Bell Canyon, which represents an integral part of Sandy's future water vision.

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APPENDIX A

LIST OF PREPARERS

SANDY CITY MAYOR

Tom Dolan

SANDY CITY COUNCIL

Bryant Anderson
Scott Cowdell
Linda Martinez-Saville
Don Pott
Crickett Raulston
Dennis Tenney
John Winder

SANDY CITY DEPARTMENT OF PUBLIC UTILITIES

Judith Bell, Director
Larry Bowler, Operations Manager
Mike Wilson, Engineering Manager
John Oakeson, Compliance Manager/Assistant Operations Manager
Bryce McEuen, Attorney
Traci Ross, Secretary

CITIZENS ADVISORY COMMITTEE

Bob Augenstein
Chris Auman
Troy Ayers
Ron Bullock
John Carman
Bruce Cuppett
Rick Davis
Mike Dennis
Nick Duerksen
Scott Earl
John Files
David Gardner
John Guldner
Brian Harris
Chuck Horman
Art Hunter
Dan Jiron
Gordon Johnson
Lance Larkin
Carol Majeske
Bob Mead
Don Milne
Ron Raddon
Crickett Raulston
Florence Reynolds
John Shakula
Nancy Shay
David Slaughter
Shazelle Terry
Diana van Uitert
John Winder

APPENDIX B

GLOSSARY

ACRE-FOOT OF WATER af - The volume of water that will cover an area of one acre to a depth of one foot.

BACK COUNTRY Recreation use that requires few, if any, improvements and usually occurs in areas greater than 1 mile from established roads.

RECREATION

CFS cfs - cubic feet per second.

DEQ Utah State Department of Environmental Quality.

DISPERSED RECREATION Recreation not limited to controlled, established recreation areas.

DRAINAGE AREA The land area contributing runoff to a stream system.

EFFLUENT Processed water coming out of a facility, finished water.

EPA Environmental Protection Agency.

FECAL COLIFORM Group of microscopic organisms found in the gut of warm blooded animals.

FEMA Federal Emergency Management Administration.

FRONT COUNTRY RECREATION	Recreation that requires facilities, resulting in the concentrated use of an area, such as campgrounds.
HYDROLOGIC	Referring to the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.
INFLUENT	Source water coming in to a facility, untreated water.
INTERCONNECT	Road, lift, tram, etc., that would allow easy access between ski resorts in neighboring canyons.
JVWCD	Jordan Valley Water Conservancy District.
MOU	Memorandum of Understanding.
MWDSLS	Metropolitan Water District of Salt Lake & Sandy.
OHV	Off-Highway-Vehicle.
TOTAL COLIFORM	Group of microscopic organisms generally found when fecal contamination from warm blooded animals is present, indicator organisms.
UDOT	Utah Department of Transportation.
USFS	Utah States Forest Service.
WATERSHED	For purposes of this plan, the term "Sandy City Watershed"means the land area that drains into existing or proposed Sandy City culinary water diversion points and includes, but is not limited to, Little Cottonwood Canyon, Bell Canyon, Middle Fork of Dry Creek, South Fork of Dry Creek, Rocky Mouth Canyon, Little Willow Canyon and Big Willow Canyon, as shown on page 1-5. Under Code 10-8-15, Sandy City's jurisdiction extends to the Sandy City Watershed as defined herein and to the watershed of the Provo River, including the trans-basin diversions for the Duchesne and Weber Rivers.
ZONING	The process used to establish or distinguish an area from other similar areas for a specific purpose.

APPENDIX C

ISSUES IDENTIFIED IN SCOPING MEETINGS

Meeting participants identified over forty issues during the public scoping meeting held on Wednesday, June 14, 2000 in Sandy City Hall.

This is a summary of public comment on the proposed Sandy Watershed Management Plan.

WATER RESOURCES

- Sandy City water rights and allocations (How much water does Sandy have, where is it located, and how is it being used?)
- Sandy City water needs (How much water does Sandy need, how is it obtained, and what percentage is "owned" by Sandy?)
- What percentage of Sandy's water comes from the watershed?
- Interlocal agreements and contracts (Conservancy Districts, neighboring communities, etc.)
- In-stream flow requirements
- Stream Status – Impaired or Non-Degradation Stream Status
- Conservation Strategies – Gray Water - xeriscaping - Aquifer Injection

WATER QUALITY

- Current watershed water quality
  - Canyon specifics? (varying uses and use levels, restrictions, diversion points?) camping, hiking, mines, development, facilities, etc.
- Trends?
  - Any connection between uses and water quality, diversion points?
- Method and location of monitoring stations
- Possible causes of water quality degradation
  - Snow Making, Salt, Human Impacts, Storm Water, Waste Water, Ski Resorts

Watershed Uses

Recreation

- Types of activities occurring and possible impacts to the watershed, level, and location of use (may vary canyon to canyon)

  camping - too close to stream in most cases (canyons are very narrow, limited opportunities); associated activities (fire pits, swimming, dishes, trash, etc.); heavy use at bottom, compacted areas, vegetative impacts, erosion; no restroom facilities

  hiking - heavy use at bottom, trail condition and use (impacts?) decreases with distance and elevation?; Sandy City approach to allowing use, Bonneville Shoreline Trail, trail head locations, improvements, access, private property concerns, signage, etc.

  picnicking - heavy use at bottom, near streams or reservoirs; few, if any improvements; associated activities (fire pits, parties, swimming, dishes, trash, etc.); heavy use at bottom, compacted areas, vegetative impacts, erosion; no restroom facilities

  horses - identify use areas, limited information available, research impacts

  dogs - identify use areas, limited information available, research impacts

Residential Development

- Need to determine a coherent city approach to development
- Level and location of development occurring, possible impacts to the watershed (may vary canyon to canyon)
  - What guidelines or restrictions are in place?
  - How well do current City land use regulations and ordinances protect the watershed?
  - Question of inadequate guidelines/ordinances or enforcement?
  - Development above and adjacent to diversion points
  - Associated impacts include topography alteration, stream channelization, storm water runoff, fertilizers, septic tanks, etc.
  - Need to coordinate development with County (approval of location and septic systems) such as Dimple Dell area
  - Possible guidelines for:
    - flood plains
    - stream setbacks
    - storm water
    - sewer
    - slopes
    - vegetation removal
    - cuts and fill
    - erosion control

Mining

- Level and location of use (past or active sites), possible impacts to the watershed (may vary canyon to canyon)
  - Bells Canyon - several mines and overburden piles, possible iron oxide and hydrocarbons in water

Watershed Management Strategies

- Sandy City priority to protect watershed?
- Regulations and enforcement?
  - What were the Bell Canyon Irrigation Co. policies and restrictions?
  - Watershed development guidelines addressing issues identified in residential section
- Cooperative partnerships with neighboring communities, conservancy districts, land owners, etc.
  - Fee for Use – Other Funding Mechanisms – Who has access?
- Security/Safety

Education

- Increase public understanding of watershed issues, signs, and enforcement, identify implementation "partners"
  - Neighboring Communities
  - Forest Service
  - Conservation District
  - Metropolitan Water District of Salt Lake & Sandy
  - Civic Groups
- Existing MOU's and Interlocal Agreements

Partnerships

- Who else is involved and what resources do they bring to the table? (Funding, regulatory power, enforcement, land ownership, etc?)

Other Issues

- Agriculture
- Grazing

APPENDIX D

RELEVANT SANDY CITY LAND USE REGULATIONS

EXISTING SANDY CITY LAND DEVELOPMENT CODE

Existing Sandy City land use development policies and practices are reflected through the City's Land Development Code. These ordinances apply to all properties within the jurisdictional boundaries of Sandy City.

Due to the City's extraterritorial jurisdiction rights to protect its watershed resources, watershed management ordinances adopted by the City apply to all areas within the City's identified watershed boundaries.

Although the City currently has not adopted specific watershed protection ordinances, several of the City's existing land use regulations complement the community's watershed management objectives.

Sensitive Lands Overlay

The City's Sensitive Area Overlay Zone *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-2* identifies the following objectives:

1. Protect the public from natural hazards of storm water runoff and erosion by requiring....the minimal removal of natural vegetation.

2. Minimize the threat and consequential damages of fire in hillside areas by establishing fire protection measures.

3. Preserve natural features, wildlife habitat, and open space.

4. Preserve public access to mountain areas and natural drainage channels.

5. Retain natural topographic features such as drainage channels, streams,...trees, and other natural plant formations.

6. Encourage minimal cuts and fills.

7. Encourage a variety of development [and land use] concepts that are compatible with the natural terrain of sensitive areas and will preserve open space and natural landscape.

8. Establish land use management criteria that will encourage protection of natural elements while allowing a harmonious and satisfying residential environment.

9. Encourage location, design, and development of building sites to provide maximum safety and human enjoyment while adapting the development to the best use of the natural terrain.

Development Site Plan Review

Materials required as part of a Development Site Plan review for properties within the Sensitive Area Overlay include:

Soil Characteristics Report including flood history and proximity of project to known flood areas and drainage channels *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-8 (g)(1).*

Vegetation Report including location of existing vegetation, vegetation to be removed, vegetation to be planted, slope stabilization measures, and an analysis of environmental effects on slope stability, soil erosion, water quality, fish and wildlife, and fire hazard *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-8 (g)(2).*

Geologic Conditions Report identifying unique geological characteristics of the site and ground water features *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-8 (g)(3).*

Grading and Drainage Report including a storm water and erosion management plan *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-8 (g)(4).*

Floodplains

1. Develop standards required for development in or adjacent to FEMA-designated floodplains *Sandy City Land Development Code, Subdivision Design Standards, 15-35-9.*

2. No structures within FEMA-designated 100-year floodplains *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(2).*
3. Conditional use permits required for development (other than structures)

within FEMA-designated 100-year flood plains *Sandy City Land Development Code, Floodplain Hazard Regulations, 15-20-12.*

4. Development encroachments in floodways are prohibited unless they are determined "non-impacting" by Sandy City *Sandy City Land Development Code, Floodplain Hazard Regulations, 15-20-16 (a).*

5. No cuts allowed within natural drainages unless adequate mitigation plans have been approved *Sandy City Land Development Code, Grading and Excavation Regulations, 15-19-5 (a)(4).*

Streams and Waterways

1. Alteration or relocation of natural waterways requires Public Utilities Engineering approval and permits *Sandy City Land Development Code, Subdivision Design Standards, 15-35-10 (B)* and Salt Lake County Division of Flood Control and Army Corps of Engineer approval and permits *Sandy City Land Development Code, Subdivision Design Standards, 15-35-10 (A).*

2. Alterations to streams/water courses require Salt Lake County Division of Flood Control and Water Quality approval and permits *Sandy City Land Development Code, Floodplain Hazard Regulations,15-20-13 (c)(1)* and State Engineer approval and permits *Sandy City Land Development Code, Floodplain Hazard Regulations, 15-20-13 (c)(2).*

3. Grading permit applications (preliminary and final grading plans) require a description of the location, width, direction of flow, and approximate location of banks for any potentially affected watercourses *Sandy City Land Development Code, Grading and Excavation Regulations, 15-19-3 (a)(5), (a)(10) & (b)(5).*

4. Grading and drainage plans are required for projects within sensitive areas that incorporate streams or waterways *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-8 (4).*

5. Conditional use applications for development within FEMA-designated 100-year floodplains must describe the extent to which streams/watercourses may be altered *Sandy City Land Development Code, Floodplain Hazard Regulations, 15-20-12 (d).*

6. Existing natural drainage systems [channels/ways] will be utilized, as much as possible, in [their] unimproved [natural] state *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(3)(D).*

Slopes

1. No development or grading permitted on slopes 30% or greater *Sandy City Land Development Code, Performance and Development Standards, 15-13-3 (P).*

2. Required setbacks from slopes of 30% or greater *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-6 (b)(1).*

3. No grading to occur on any land where natural slope is equal to or in excess of 30% *Sandy City Development Code, Performance and Development Standards, 15-13-3 (P)(4).*

4. No cuts and fills on slopes equal to or greater than 30% *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (f)(6).*

5. No vegetation to be removed on a continuous hillside, crest, or slope of 30% or greater unless recommended by the Engineering Department and approved by the planning commission *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c)(6).*

6. Erosion control measures must be implemented on cut and fill slopes *Sandy City Land Development Code, Grading and Excavation Regulations, 15-19-5 (e).*

Vegetation

1. Preconstruction vegetation removal plan must be approved by the Sandy City Planning and Engineering Departments *Sandy City Development Code, Performance and Development Standards, 15-13-3 (P).*

2. Construction plans to minimize vegetative cover disturbance *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(4).*

3. No vegetation shall be removed on a continuous hillside, crest or slope of 30% or greater unless recommended by the Engineering Department and approved by the planning commission *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c)(6).*

4. Loss of trees, groundcover, and topsoil shall be minimized on any grading project *Sandy City Land Development Code, Grading and Excavation Regulations, 15-19-6 (e)(1).*

5. Vegetation will be removed only when absolutely necessary *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c)(4).*

6. Revegetation guidelines must be observed *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c).*

7. All areas cleared of vegetation during construction will be revegetated *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c)(1).*

8. Property owners and/or developers are fully responsible for any destruction of native or applied vegetation *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (c)(9).*

Grading and Excavation

1. Grading and drainage for any lot must follow current Sandy City requirements as determined by the Sandy City Engineering Department *Sandy City Development Code, Performance and Development Standards, 15-13-3 (P).*

2. Minimum performance requirements are established for all grading and excavation *Sandy City Development Code, Grading and Excavation, 15-19-1.*

3. Site plans must include grading, drainage, and clearing plans (including vegetation removal) and be approved before such activities begin *Sandy City Land Development Code, Performance and Development Standards, 15-13-3 (P)(2).*

4. Grading permit applications (preliminary and final grading plans) require a description of the location, width, direction of flow, and approximate location of banks for any potentially affected watercourses *Sandy City Land Development Code, Grading and Excavation Regulations, 15-19-3 (a)(5), (a)(10) & (b)(5).*

5. Grading shall be kept to a minimum and shall not occur on any land where natural slope is equal to or in excess of 30% in accordance with the City's Sensitive Area Overlay Zone *Sandy Land City Development Code, Performance and Development Standards, 15-13-3 (P)(3) & (P)(4).*

6. No cuts or fills within 100-year floodplain or drainage channels without approved mitigation plans in place *Sandy City Development Code, Grading and Excavation, 15-19-5 (a)(4) & Sandy City Development Code, Grading and Excavation, 15-19-5 (b)(3).*

7. No grading, cuts, fills, or terracing allowed on a continuous hillside, crest or slope of 30% or greater unless otherwise approved *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (f)(6).*

8. No cuts and fills greater than 10 feet *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (f)(4).*

9. Grading and excavation design standards include maximum slopes (cuts and fills) no steeper than two horizontal to one vertical *Sandy City Land Development Code, Grading and Excavation, 15-19-5 (a)(1)(A)* & *Sandy City Land Development Code, Grading and Excavation, 15-19-5 (b)(4).*

10. Grading and excavation design standards include drainage and erosion control measures *Sandy City Land Development Code, Grading and Excavation, 15-19-5 (d) & (e).*

11. Preservation of natural drainage channels *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-2 (d).*

12. Retention of natural features including drainage channels and streams *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-2 (e).*

13. Natural drainage systems to be utilized in their unimproved state *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(3)(D).*

14. Use of natural vegetation, prohibition of excessive excavation and terracing *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-2 (f).*

15. Encourage minimal cuts and fills *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-2 (g).*

Erosion

1. Erosion control measures required during and after construction *Sandy City Land Development Code, Grading and Excavation, 15-19-3 (b)(6) & 15-19-4 (d)*, and *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(5) & 15-14-8 (g)(4).*

Storm Water Management

1. Onsite storm water runoff collection facilities are required *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(3).*

2. Surface water runoff systems must be provided *Sandy City Land Development Code, Subdivision Design Standards, 15-35-7.*

3. Storm water drainage and management facilities must be approved by the

Sandy City Engineering Department *Sandy City Land Development Code, Performance and Development Standards, 15-13-3 (P).*

4. Existing natural drainage systems [channels/ways] will be utilized, as much as possible, in [their] unimproved [natural] state *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (b)(3)(D).*

Road Location and Construction

1. Road location and construction will follow natural topography as nearly as possible *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-7 (g).*

Trail Location and Construction

1. Trails will follow natural topography, minimize vegetation disturbance, and control erosion. Trail cuts and fills may not exceed two feet in height. Community Development Department Director and City Engineer approval required prior to construction. *Sandy City Land Development Code, Sensitive Area Overlay Regulations, 15-14-6 (e)(1-4).*

Fire Protection

1. Development adjacent to public lands must provide access for fire protection vehicles and equipment *Sandy City Land Development Code, Sensitive Area Overlay, 15-14-7 (e)(4) & 15-14-7 (g)(7).*

Septic Tanks

1. Septic tanks are not permitted in primary recharge areas. They are allowed in other areas as approved/permitted by the Utah State Department of Health. *Sandy City Land Development, Drinking Water Source Protection Ordinance, 15-37-6 (G).*

2. Mandatory connection for facilities within 300 feet of an existing sewer system *Sandy City Land Development, Drinking Water Source Protection Ordinance, 15-37-6 (G).*

3. City Sewage Disposal Ordinance, Sandy City Municipal Code -Title 18, "mandatory connection" for facilities within 300 feet of existing systems.

Groundwater Protection

1. Groundwater protection measures must be observed *Sandy City Land Development Code, Drinking Water Source Protection Ordinance, 15-37; State-required Surface Water Protection Ordinance.*

Household Waste

1. Household hazardous waste (fertilizers, herbicides, pesticides, etc.) will be handled as per existing City/County regulations.

APPENDIX E

WATER QUALITY BACKGROUND

Water Quality

Sandy City obtains a significant portion of its culinary water supply from canyon streams originating in the Wasatch Mountains. These canyons include Little Cottonwood, Bell, Middle Fork/South Fork of Dry Creek, Rocky Mouth, and Big Willow. Water from these canyons is treated in treatment plants and distributed to residents of Sandy City and Salt Lake County. Reliance on these water sources is such that the Sandy City Department of Public Utilities should closely monitor and regulate any activities that may threaten water quality. Though recreation activity in these canyons has increased, water seems to be of high quality.

As identified in Chapter 2, Recommendations, Sandy City will gather baseline data in order to monitor watershed use effects. This section presents a discussion of each of the selected key contaminant indicators which will be included in baseline studies. To define the significance of the data it is important to understand the potential sources of the indicator, and the transport and fate of the indicator in the mountain stream environment.

A. Coliform Bacteria

Coliform can be used as an indication of contamination because coliform tend to exist in high quantities within fecal matter (100 to 400 billion per day discharge by humans[i]), and thus provide a good indication or warning of possible contamination by other fecal-born species. Some water borne pathogens are difficult to detect or the tests may be complex, time consuming, and often not sufficiently sensitive or selective. Coliform testing is relatively simple and inexpensive, thus rendering it the method of choice.

Sources and Fate Of Total Coliform Bacteria

"The coliform group of bacteria includes all aerobic and facultative anaerobic, gram-negative, nonspore-forming rod-shaped bacteria that ferment lactose with gas formation."[ii] Included in the coliform class of bacteria are the genera *Escherichia* and *Aerobacter*. Coliform bacteria have been found to increase in viable bacterial numbers under favorable conditions in pipe distribution systems.[iii]

According to the American Water Works Association, "Finding coliform densities ranging from 1 to 150 organisms per 100 mL may be possible with their occurrence widespread in the distribution system."[iv] There is a possibility that coliform could colonize in streams within the slower moving areas. Porous media such as rocks may provide a good surface to which the bacteria can attach and colonize. Total coliform life expectancies are on the order of days. Based on the results of deep well studies, many coliforms survive better in colder waters. Coliform life expectancies have not been verified in open stream flows.

"The use of coliforms as indicator organisms is complicated by the fact the *Aerobacter* and certain *Escherichia* can grow in soil. Thus, the presence of coliforms does not always mean contamination with human wastes. Apparently, *Escherichia coli* (E. coli) are entirely of fecal origin. There is difficulty in determining E. coli to the exclusion of the soil coliforms; as a result, the entire coliform group is used as an indicator of fecal pollution." [v] Therefore, total coliform presence in water is not proof of fecal contamination, however, total coliform will always be present when there is fecal contamination. Though the significance of coliform occurrences should not be ignored because they may indicate a potential pathway for pathogen penetration into the water supply, sole reliance on coliform occurrence may not be adequate in defining the source of the contamination. If coliforms occur repeatedly at levels higher than background, then perhaps a more stringent monitoring program should be employed in order to determine for certain that there is animal-based contamination.

Sources and Fate of Fecal Coliform Bacteria

Fecal coliforms are a subgroup of total coliforms, and are usually found in much lower numbers. They are more indicative of contamination from a warm-blooded animal source. Therefore, they can come from both humans as well as animals. However, even though fecal coliform testing may rule out soil borne coliforms, they may be from any warm-blooded animal source, as discussed previously, and not necessarily an indicator of a human source. "In many situations where human pollution is suspected on the basis of [fecal] coliform test results, the actual pollution may, in fact, be caused by animal discharges."[vi] Fecal coliform density per gram of feces and average contribution per capita per day is provided on Table 1 for human beings and some warm blooded animals.

Table 1 Fecal Coliform Contribution Per Capita From Human Beings And Some Animals (After Tchobanolglous, 1987)		
	Average indicator density/g of feces	Average contribution/capita/day
	Fecal Coliform (10^6)	Fecal Coliform (10^6)
Human	13.0	2,000
Chicken	1.3	240
Cow	0.23	5,400
Duck	33.0	11,000
Pig	3.3	8,900
Sheep	16.0	18,000
Turkey	0.29	130

As can be seen from the table above, many animals have higher fecal coliform production than humans. Therefore, relying solely on fecal coliform counts as an indicator of human contamination may not be correct. Fecal coliform may be expected to live in a cold water environment for at least the duration of water flow from the upper reaches of the canyon to the canyon mouth in any of the Wasatch Canyons. Coliforms survive well in cold water (the colder the better) with a survival time on the order of days.[vii] In order to minimize differential death rates, samples should be taken no further down stream than 24 hours of flow time from the source of pollution.[viii] With these two items in mind, and the fact that these creeks take less than 24 hours to flow from top to bottom, survival of coliform from any source in the canyon is possible. However, no studies have been found confirming life expectancies of fecal coliform in cold highly oxygenated water.

B. Nutrients

Nutrients, specifically nitrogen and phosphorous, are essential to the growth of bacteria and plants.[ix] Other trace elements such as iron (Fe) are also required for biological growth. However, nitrogen and phosphorous are the major contributors to the production of algae. Algae in turn can cause taste and odor problems within water being used for drinking purposes. Methods for controlling algal blooms or growth include addition of Chelated copper compounds or potassium permanganate to the water, or simply controlling the nutrient loading. Nitrogen is also required in metabolic processes of microbial populations. If the water lacks sufficient nitrogen and/or phosphorous, algae growth will be repressed. Waste waters or organic wastes are a good source of nitrogen for bacteria.

Nitrogen Sources and Fate

Nitrogen has its origins as atmospheric nitrogen. It is incorporated into terrestrial

systems through nitrogen fixing bacteria, lightening, direct conversion to ammonia, or fertilizer manufacturing processes. From there it enters the food chain where it is taken up by plants and eventually animals. Animals then discharge nitrogen in the form of urea or feces. Bacterial decomposition of the feces along with hydrolysis of the urea then convert the nitrogen to ammonia. Ammonia is then converted to nitrite and nitrate, or to nitrogen gas. Nitrate is especially soluble in water and therefore will move about freely within the aquatic system.

The United States Environmental Protection Agency (EPA) has determined that nitrate poses an acute health concern at certain levels of exposure.[x] The most common sources of nitrate in water include fertilizer, sewage, and wastes from humans and animals. Excessive levels of nitrate in drinking water may cause serious illness and sometimes death in infants less than six months of age. The EPA has set the drinking water standard at 10 mg/l for nitrate to protect against the risk of these adverse effects.[xi] Elevated levels of nitrates are often used as an indicator of human effects on stream water quality.

Phosphorus Sources and Fate

Slope and stream erosion of phosphorous bearing soils (including top soils), and animal and human feces, are sources of phosphorous for the canyon streams. Three types of phosphate are usually of interest: ortho, poly, and organic. Orthophosphates are available for immediate biological metabolism without further breakdowns. Polyphosphates include molecules with oxygen atoms and two or more phosphorous atoms. Polyphosphates undergo hydrolysis in aqueous solutions and revert to orthophosphate forms; however, the hydrolysis is typically slow. Organically bound phosphorous is generally not available for algae growth without anaerobic bacterial conversion.

The major phosphorous removal processes in natural systems are chemical precipitation and adsorption while plants organically bind only small amounts. Phosphorous has a high tendency to bind with soil particles. Once it is bound, it is not likely to be readily released back into the environment. Orthophosphates are absorbed by clay minerals and certain organic fractions within the soil. Chemical precipitation with alum, iron, or aluminum also occurs, but at a slower rate. Sorption of phosphorous onto soils is the primary phosphorous removal process.

C. Turbidity

Turbidity is a measure of the suspended matter in water that interferes with the passage of light. Materials in the water that cause turbidity may range from small colloidal particles, to coarse dispersions. Much of the material that causes turbidity is inorganic matter, though a significant portion is also caused by organic matter. It is this organic matter that causes concern. The organic matter serves as food for bacterial colonies. As the colonies grow, additional turbidity is

introduced. Some of these organics may also induce the growth of algae, meaning they may contain large amounts of nitrogen and phosphorous.

Turbidity effects on water quality include: 1) Aesthetics, 2) Interference with filterability, and 3) Interference with disinfection. Aesthetically pleasing water instills confidence in the consumer that the water is pure and not polluted with wastes. As turbidity increases, the cost associated with filtering the water increases. Disinfection is impacted by turbidity also. If particles causing turbidity are in the water, then pathogenic organisms may not come into contact with the disinfectant. That is to say, that the organisms may be shielded within or by a particle.

The amount of raw water turbidity (suspended solids) may also determine the type of treatment required. Water with consistently high turbidity (greater than 5 NTU) requires conventional treatment like coagulation, flocculation, sedimentation, and filtration. Water with consistently low turbidity (less than 5 NTU) may be treated by direct filtration, which is basically conventional treatment without sedimentation. Direct filtration treatment plants are less costly to construct than conventional plants. Turbidity can be a significant issue with respect to operation costs. Higher turbidity requires higher dosages of coagulating chemicals, more frequent back washing, and it produces greater quantities of sludge for disposal. In addition, fluctuating turbidity levels (spikes) are difficult for plant operators to manage since fluctuating turbidity requires fluctuating levels of chemical feed. Watershed management practices that lower and stabilize turbidity levels are very important with respect to water treatment.

D. Metal Sources and Fate

Trace quantities of many metals are important in most waters and are required for biological growth. Some of these trace quantities include metals such as nickel (Ni), lead (Pb), manganese (Mn), cadmium (Cd), chromium (Cr), zinc (Zn), iron (Fe), copper (Cu), and mercury (Hg). However, a few of these metals are classified as heavy metals. Heavy metals are listed in Table 2 along with associated health concerns resulting from elevated concentrations.

Table 2
Heavy Metals

Metal	Health Concern
Barium (Ba)	Increase blood pressure and nerve block
Cadmium (Cd)	Carcinogen
Chromium (Cr)	Carcinogen
Lead (Pb)	Brain damage, Birth defects
Mercury (Hg)	Central nervous system damage, Birth defects

Table 2 Heavy Metals	
Metal	**Health Concern**
Silver (Ag)	Dis-coloration of skin and eyes

Heavy metals are classified as priority pollutants, meaning they are hazardous to human health at elevated levels. Even though they may be required in small quantities to support life, larger quantities may be toxic. Sources of heavy metals in canyon streams include: natural ground water flow through rock formations, mine tunnel discharges, vehicle fluid leakage (crank case oil, anti-freeze, etc.), and surface runoff from mining affected areas.

APPENDIX F

OTHER DOCUMENTS RELEVANT TO THE PLAN AREA

The Sandy City watershed planning process included identifying and reviewing documents and materials relevant to the watershed area and the City's water quality protection objectives. Listed below, documents 1-25 relate directly to Sandy's watershed resource management and land use issues. Brief overviews of these documents, including specific policies and objectives relevant to the City's planning efforts, were prepared by project consultants and compiled as an "Existing Document Report". As additional resources, documents/materials 26-39 were submitted/gathered by committee members and used throughout the plan development process as resource analysis references. This latter information may also be useful during plan implementation.

Copies of the *Existing Document Report* or any of the articles/materials listed below can be obtained by contacting the Sandy City Public Utilities Department or the group, agency or entity that prepared/published the resource.

Documents Relating Directly to Watershed Management/Land Use

1. Sandy City Land Development Code (November 1999)
2. Sandy City Parks, Recreation & Trails Master Plan (June 1996)
3. Sandy City Community Development Department Statistical Report (1998)
4. Salt Lake City Watershed Management Plan (November 1999)
5. Wasatch Canyons Master Plan (1989)
6. Sandy City Irrigation Study - *Water Rights and Agreements* (1994)
7. DEQ (Department of Environmental Quality) R309-605, Source Protection: Drinking Water Source Protection for Surface Water Sources (2000)
8. Wasatch-Cache National Forest Land and Resource Management Plan
9. Salt Lake County Ordinance Title VII, Chapter 1 thru 9 for Flood Control, Storm Drainage and Water Quality (June 1982)
10. Water Quality Data, Jordan Valley Water Conservancy District (2000)
11. Sandy City Water Management and Conservation Plan - *Executive Summaries* (May 1996)
12. Bell Canyon Creek Pressurized Irrigation Feasibility Study, Final Report (September 1998)

13. Hydrogeology of Recharge Areas and Water Quality of the Principal Aquifers along the Wasatch Front and Adjacent Areas, Utah (1994)
14. National Forest Service Materials - Special Orders regarding Wilderness Areas including the Lone Peak Wilderness Area and Special Orders on Camping/Camp Fire/Swimming/Animal Order Restrictions for the Wasatch-Cache National Forest (May and June 1997)
15. Town of Alta Dog Ordinance (March 2000)
16. Town of Alta General Plan (1992)
17. Town of Alta Zoning Ordinance
18. Guidance Report I: Riparian Buffer Programs, a guide to developing and implementing a riparian buffer program as an urban storm water best management practice (May 1993)
19. 1999 Summary of Operations, Jordan Valley Water Conservancy District
20. The Provo Canyon Scenic Byway Corridor and Watershed Management Plan (*draft* dated July 2000)
21. Preliminary Alternatives, Wasatch-Cache National Forest Plan Revision (August 2000)
22. Salt Lake City Watershed Ordinance
23. Map - Land Ownership in Bell Canyon to Little Willow above Wasatch (2000)
24. Map - Proposed Pepperwood Hills, Condominium (2000)
25. Map - Seven Springs, Residential Addition (2000)

Documents Utilized for Resource Analysis

Additional Documents Submitted by Committee Members

26. Materials on Impacts of Horse Recreation
    a. *Does Horse Manure Pose a Significant Risk to Human Health?*
    b. *Pathogens Excreted by Livestock and Transmitted to Humans Through Water*
    c. *The Prevalence of Shedding of Cryptosporidium and Giardia spp. Based on a Single Fecal Sample Collection from each of 91 Horses Used for Backcountry Recreation*
    d. Water Cooties
    e. *Scare Tactics*
    f. Letter to the Editor from Pegasus Veterinary Clinic
    g. *The Prevalence o f Cryptosporidium/ Giardia in the Trail Horse Population Utilizing Public Lands*
    h. *The Doctor from Outer Space*
    i. *It is all a lot of Horse Manure*
    j. *Genetic Polymorphism Among Cryptosporidium parvum Isolates: Evidence of Two Distinct Human Transmission Cycles*
    k. Various Email Documents
    l. *Cryptosporidium Parvum Fact Sheet*
27. Materials on Household Chemicals
    a. *With the Splash of VOCs*

b. *Hazardous Wastes from Homes*

28. Watershed Management for Potable Water Supply: Assessing the New York City Strategy - prepared by the National Research Council (2000)

29. Aurora Reservoir Management Plan - prepared by Brown & Caldwell, dated November 22, 1996

30. Materials from EPA Source Water Protection Symposium: A Focus on Waterborne Pathogens, dated October 28-31, 1998
    a. *The Economic Costs of Cryptosporidium Contamination Drinking Water Supplies*
    b. *Sources of Environmental Contamination With Cryptosporidium: Potential Roles of Wild and Domesticated Animals*
    c. *Using Relative Risk and Outcome to Establish Priorities Among Watershed Control Activities*
    d. *Waterborne Disease and Liability Incurred by Drinking Water Suppliers*
    e. *What are the Emerging Pathogens in Water*
    f. *Health Effects of Emerging Waterborne Pathogens*
    g. *Tools for Source Water Protection: Regulation and Incentives*
    h. *Early Warning Systems: A Case Study - Artificial Intelligence Modeling Techniques*
    i. *A Tale of Two Watersheds*
    j. *Watershed Controls for the Salt Lake City Water Supply*
    k. *Guarding Against Cryptosporidium - A Watershed Protection Plan to Keep Cattle at Home on the Range in San Francisco*
    l. *Monitoring Streams for Effect of Wastewater Discharge and Rainfall on Giardia and Cryptosporidium in Illinois*
    m. *Relationship Between Waterborne Parasites (Cryptosporidium and Giardia) and Agricultural Production in North Saskatchewan River, Alberta, Canada*
    n. *Des Moines Water Works Urban Creek Studies*
    o. *Protecting Drinking Water Supply Sources: San Francisco's Water Quality Vulnerability Zones*
    p. *Cryptosporidium: Water Treatment and Watershed Protection - A Balancing Act*
    q. *Alternative Indicators For Delineation of Source - Specific Microbial Inputs Reservoirs*
    r. *Male-Specific Coliphage As Indicators of Watershed Pollution*
    s. *Watershed Management for Sydney's Water Supplies*
    t. *The Impacts of Multiple Use On Modesto Reservoir Microbial Water Quality*
    u. *Source and Occurrence of Pathogens in Watersheds*

31. Confirmation of Human-Pathogenic Microsporidia *Enterocytozoon bieneusi, Encephalitozoon intestinalis,* and *Vittaforma corneae* in Water, *Applied and Environmental Microbiology,* (September 1998), pp. 3332-3335 - prepared by Scot Dowd, Charles P. Gerba & Ian L. Pepper, University of Arizona

32. Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources, *Water Resources*, (1991), Vol. 25.1, pp. 37-42 - prepared by Joan B. Rose, Gwo-Shing Sun, Charles P. Gerba, & Norval A. Sinclair from University of Arizona
33. Modeling the Impact of Body-Contact Recreation on Pathogen Concentrations in a Source Drinking Water Reservoir, *Water Resources,* (1998), Vol. 32.11, pp. 3293-3306 - prepared by Michael A. Anderson, Mic H. Stewart, Marylynn V. Yates, & Charles P. Gerba
34. Water Quality Study of Graywater Treatment Systems, *Water Resources Bulletin,* (February 1995), Vol. 31.1, pp. 109-116 - prepared by Charles P. Gerba, Timothy M. Straub, Joan B. Rose, Martin M. Karpiscak, Kenneth E. Foster & Richard Brittain
35. Occurrence of Rotaviruses and Enteroviruses in Recreational Waters of Oak Creek, Arizona, *Water Resources,* (1987), Vol. 21.11, pp. 1375-1381 - prepared by Joan B. Rose, Rebecca L. Mullinax, Shri N. Singh, Marylynn V. Yates, & Charles P. Gerba
36. Assessment of Enteric Pathogen Shedding by Bathers During Recreational Activity and its Impact on Water Quality, *Quantitative Microbiology,* (in press) - prepared by Charles P. Gerba
37. Source and Occurrence of Pathogens in Watersheds - prepared by A.L. Mager, J. Standridge, S.M. Kluender, & L.L. Peterson, Wisconsin State Laboratory of Hygiene
38. Pollution Prevention Fact Sheet: Animal Waste Collection - provided by Florence Reynolds of Salt Lake City Public Utilities
39. Study Finds Animal Feces a Major Urban Water Polluter, *Environmental News Network,* (December 11, 1999) - prepared by Lucy Chubb

APPENDIX G

RESOURCES

Town of Alta, General Plan, 1992.

Town of Alta, Zoning Ordinance, 1992.

Back Country Horsemen, 2001.

Green, J.B., *Watershed Planning,* The Rocky Mountain Land Use Institute. 1997.

Lane Council of Governments and Lane County Land Management Division, *McKenzie Watershed Council Action Plan for Recreation and Human Habitat.* McKenzie Watershed Council.

Lane Council of Governments and Lane County Land Management Division, *McKenzie Watershed Council Technical Report for Water Quality and Fish and Wildlife Habitat.* McKenzie Watershed Council.

Lane Council of Governments and Lane County Land Management Division, *McKenzie Watershed Council Action Plan for Water Quality and Fish and Wildlife Habitat.* McKenzie Watershed Council.

Metropolitan Water District of Salt Lake and Sandy, *Personal Communication,* 2000.

National Water Research Institute, *The Santa Ana River Watershed Workshop,* 1995.

ORCA state of the industry report, 1997.

Salt Lake City Public Utilities Department, 2000.

Salt Lake City Department of Public Utilities, *Salt Lake City Watershed Management Plan.* Salt Lake City Corporation, 1999.

Salt Lake City Department of Public Utilities, *Salt Lake City Watershed Management Programs 1847-1993.* Salt Lake City Corporation. 1993.

Salt Lake County Planning Division, *Revised Sensitive Lands Protection Regulations,* 1998.

Salt Lake County Planning Division, *Wasatch Canyons Master Plan,* 1989.

Salt Lake County Planning Department, 2001.

Sandy City Parks & Recreation Department, 2001.

San Francisco Public Utilities Commission, *Watershed Newsletter,* San Francisco City span, World Wide Web Site. 1995.

San Miguel Watershed Coalition, *San Miguel Watershed Plan: A Collaborative Management Framework for the San Miguel Basin.* San Miguel Watershed Coalition, 1997.

Schueler, T., *Crafting Better Urban Watershed Protection Plans,* Watershed Protection Techniques. 1995.

Standard Methods for the Examination of Water and Wastewater, (1980), 15th ed., American Public Health Association, New York.

Tchobanoglous, George and Burton, Franklin L. 1991. 3rd Edition *Wastewater Engineering Treatment, Disposal, and Reuse.* Metcalf & Eddy, Inc. McGraw Hill Inc. New York City, pp. 93.

U.S.D.A. Forest Service, *Wasatch-Cache National Forest Land and Resource Management Plan.* 1985.

U.S.D.A. Forest Service, Wasatch-Cache National Forest, 2001.

Utah Division of Water Resources, *Utah State Water Plan: Jordan River Basin,* Utah Department of Natural Resources. 1997.

Utah Division of Water Resources (in cooperation with Coon, King & Knowlton Engineers; Eckhoff, Watson & Preator Engineering; Horrocks & Carollo Engineers [&]; James M. Montgomery Consulting Engineering). April 1982. *Salt Lake County Area-Wide Water Study.*

Water Pro (Draper Irrigation Company), *Personal Communication,* 2000.