Draft Report Update

Recycled Water Master Plan

Submitted to

Big Bear Area Regional Wastewater Agency

Revised September 2005

CH2MHILL

Contents

Tables

Figures

Appendixes

Acronyms and Abbreviations

°F	degrees Fahrenheit
µ	micrometer
µmhos	micromhos
AACE	Association for the Advancement of Cost Engineering
afy	acre-feet per year
AOP	advanced oxidation process
AOX	advanced oxidation
AWTF	advanced water treatment facility
AWWARF	American Water Works Association Research Foundation
BAF	biological aerated filter
BBARWA	Big Bear Area Regional Wastewater Agency
BBCCSD	Big Bear City Community Services District
Caltrans	California Department of Transportation
CCI	construction cost index
CCR	California Code of Regulations
CDHS	California Department of Health Services
CEQA	California Environmental Quality Act
CFU	colony-forming unit
DAF	dissolved-air floatation
DU	dwelling unit
DWP	City of Big Bear Lake Department of Water and Power
ED	electrodialysis
EDC	endocrine-disrupting compound
EDR	electrodialysis reversal
EDU	equivalent dwelling unit
EHSD	Environmental Health Services Department of the County of San Bernardino
ENR	*Engineering News Record*
ET	evapotranspiration
ET_o	reference evapotranspiration

ET_{plant}	plant evapotranspiration
FBR	fluidized bed reactor
FCT	Paleozoic metaphoric carbonates
fps	feet per second
ft^2/ft^3	square feet per cubic foot
GAC	granular-activated carbon
gpm	gallons per minute
gpm/sf	gallons per minute per square foot
GRRP	Groundwater Recharge Reuse Project
GWR	groundwater replenishment
H_2O_2	hydrogen peroxide
HAA	haloacetic acid
HDPE	high-density polyethylene
hp	horsepower
I&I	Inflow and Infiltration
Kc	crop coefficient
kW-h	kilowatt-hour
LF	linear feet
LPS	low pressure sewer
MBR	membrane bioreactor
MCL	maximum contaminant limit
MF	microfiltration
mg	milligrams
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
mj/cm^2	millijoules per square centimeter
mL	milliliter
mm	millimeter
msl	mean sea level
MZP	Mesozoic granitic
NEPA	National Environmental Policy Act
NF	nanofiltration

NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
NWRI	National Water Research Institute
O&M	operation and maintenance
pCi/L	picoCuries per liter
PPCPs	pharmaceuticals and personal care products
psi	pounds per square inch
PVC	polyvinyl chloride
Qaa	Pleistocene to recent alluvium and colluvium
Qaf	alluvial fan gravel
Qal	Pleistocene to recent lake and meadow deposit
Qls	landslide deposits
Regional Board	California Regional Water Quality Control Board
RO	reverse osmosis
RWC	recycled water contribution
SCE	Southern California Edison
SLW	Precambrian quartzite
SMART	Simple Multi-Attributable Rating Technique
SR	State Route
State Board	State Water Resources Control Board
TDS	total dissolved solids
THM	trihalomethane
TIN	total inorganic nitrogen
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TN	total nitrogen
TOC	total organic compound
TSS	total suspended solids
UF	ultrafiltration
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UV	ultraviolet

UWMP	Urban Water Management Plan
Valley	Big Bear Valley
VSEP	Vibratory Shear Enhanced Processing
WAS	waste activated sludge
WDR	Waste Discharge Requirements
WERF	Water Environment Research Foundation
WWTP	Wastewater Treatment Plant

1.0 Executive Summary

1.1 Introduction

1.1.1 Purpose

The Big Bear Area Regional Wastewater Agency (BBARWA), which provides wastewater management to the Big Bear Valley (Valley), is seeking to expand the use of the effluent from its wastewater treatment plant to produce recycled water for use within the Valley. The purpose of the BBARWA Valley-wide Recycled Water Master Plan is to achieve this objective. Implementation of this master plan will result in the following benefits:

- Reduction of Valley dependence on limited groundwater supplies
- Extension of available water resources
- Provision of valuable economic and environmental benefits to Valley communities

In addition, the master plan will provide a comprehensive planning document that outlines a phased "road map" for incremental implementation of facilities to achieve the listed benefits. The master plan will be a management tool that BBARWA can use in implementing the Recycled Water Program.

1.1.2 Background

This Recycled Water Master Plan, initiated by the BBARWA, is a result of a cooperative effort by the BBARWA, the Big Bear City Community Services District (BBCCSD), and the City of Big Bear Lake Department of Water and Power (DWP). In addition, the BBCCSD and the DWP supported this effort by providing pertinent data on potential users of recycled water.

The Valley area is a resort community located in the San Bernardino Mountains approximately 100 miles northeast of the City of Los Angeles. It encompasses an area of about 70 square miles and includes two main watersheds – the Big Bear Lake watershed and the Baldwin Lake watershed. The area provides year-round recreational opportunities including biking, boating, fishing, camping, golfing, hiking, snow skiing, snowboarding, and other resort activities.

The Valley area has a growing population composed of permanent residents and seasonal visitors. The population of the area was reported to be approximately 12,000 in 2003, according to the California Department of Finance (Husing, 2003). However, the population in the Valley can expand to about 58,000 residents when measured as the sum of full-time and part-time residents (BBARWA, 2004). In addition to residents, several thousand visitors engage in outdoor activities.

1.2 Project Overview and Drivers

Population is an important driving factor in the Valley due to the limited water supply resources available. In the Valley, the primary water supply is groundwater, although use

of water from Big Bear Lake for making snow is permitted at the two ski resorts in the area, Bear Mountain and Snow Summit. As population and water demand continue to increase, the Valley faces water supply availability and reliability issues. Contributing factors to the water availability and reliability issues are (1) communities outside the Valley own the water rights for Big Bear Lake, (2) importing water from the State Water Project and/or the Colorado River Aqueduct is not feasible due to geographical location, and (3) changing demographics from part-time to full-time residents. As a result, the Valley relies almost entirely on groundwater resources, which are fed by rain and snowmelt, for the water supply. The reliance on local supplies, which are replenished naturally, exacerbates the effects of periodic droughts. As a result, implementing water conservation measures and water recycling is important to augment water supplies and increase the reliability of local water supply resources in the Valley.

1.3 Project Scope

To evaluate the potential for water recycling, the scope of the project included these key activities:

- Market assessment
- Supply evaluation
- Demand evaluation
- Facilities analysis
- Cost analysis

These activities were used to develop a phased approach to implement a recycled water program.

1.4 Report Organization

The report is organized to show the sequential steps taken in developing the activities defined by the scope. The executive summary provides an overview of the master plan, and the details are described in Chapters 2 through 8. The appendixes contain data tables to support the information provided in the body of the document. The main sections of this document are:

- **Introduction –** Contains general information on the setting, BBARWA, and project history
- **Market Assessment –** Contains information on the users and their potential recycled water demands, the potential recycled water supply, and water quality requirements
- **Pipeline Alternatives –** Contains information on the route analysis performed to evaluate route alternatives from the supply source (i.e., the wastewater treatment plant) to the potential users
- **Regulatory Requirements –** Contains information on the current regulations pertaining to recycled water use
- **Treatment Alternatives –** Evaluates treatment options

- **Cost Analysis –** Provides the unit and total costs of the recycled water program
- **Conclusions and Recommendations –** Provides the final findings of the analysis

1.5 Existing BBARWA System

The BBARWA was formed in March 1974 to provide a mechanism to oversee and conduct a study to develop a plan for wastewater management for the Valley. The BBARWA service area includes the entire 79,000 acres of the Valley (see Figure 1-1). The BBARWA receives wastewater from three separate collection systems:

- City of Big Bear Lake
- Big Bear City Community Services District
- County of San Bernardino, County Service Area 53B

Each member agency maintains and operates its own wastewater collection system and delivers wastewater to the BBARWA interceptor system for transport to the Regional Wastewater Treatment Plant (WWTP). The BBARWA operates three main lines:

- Low pressure sewer (LPS) force main, which services the City of Big Bear Lake wastewater system
- North Shore Interceptor, which services the county wastewater system
- BBARWA Trunk Line, which services the BBCCSD wastewater system and conveys flow from the North Shore Interceptor to the treatment plant

The wastewater flows from the main lines are conveyed to the BBARWA Regional WWTP located at Baldwin Lake. Currently, the BBARWA system is composed of a 4.89-million-gallons-per-day (mgd) capacity secondary wastewater treatment plant (with effluent pumping capacity at 9.2 mgd), 14.6 miles of sewer pipeline, and 1.5 miles of existing recycled water pipeline. The average daily flow treated by the BBARWA WWTP is approximately 2.2 mgd based on records over the past 5 years (1999 to 2003).

Currently, the BBARWA discharges secondary wastewater treatment plant effluent to a 480-acre site in the Lucerne Valley where it is used to irrigate alfalfa fields. The alfalfa is used to feed horses, sheep, and other livestock. While this water is being used productively, it is a local water resource that could be further treated and reused in the Valley to augment existing water supplies and improve local water supply reliability. To date over 22 billion gallons of water have been exported from the Big Bear Valley to the discharge site in the Lucerne Valley.

The BBARWA currently operates a small-scale water recycling program under three California Regional Water Quality Control Board (Regional Board) waste discharge requirement (WDR) permits. These permits allow for distribution of recycled water for construction, irrigation, and other permitted activities. Within this program, the BBARWA has about 139 user accounts of various types. Irrigation users comprise the largest number of accounts (188 user accounts), but they use a significantly smaller amount of water than construction users. In 2004/2005, the BBARWA supplied approximately 13 acre-feet of recycled water. Of this, only 12 percent went to supply irrigation users.