Chapter 6
Conclusions and Recommendations

6.1 Conclusions

Since 1901, The CSD municipal source water system has developed into a complex ever evolving system of water rights and agreements, along with infrastructure for the conveyance, storage, and treatment of water all governed by an intricate system of federal and state laws (**Figure 2.1**). This system is dependent on both local runoff and more importantly imported water as a source. Although the system is primarily dependent on imported water as a source (**Table 2.1**), the very nature of this complex and expansive system allows for the capture and storage of local runoff which can have a profound effect on source water quality since the City has a policy of maximizing the use of local water.

Records indicate that extremely dry periods frequently last several years both locally and throughout California. Locally, from 2006 through 2010 rainfall and runoff have been below historical averages (**Tables 2.5, 2.6**); therefore, the City's use of local runoff was below the historical 20% average (**Table 2.2**) and to meet demand was supplemented through the use of carry-over storage from reservoirs.

Conditions within the Local Source Water System

Due to several earthquake fault zones that exist in Southern California, along with the age of much of the source water system infrastructure, the threat of earthquake damage to the source water system remains significant. Geologic hazards such as: asbestos, mercury, and radon are not considered to be an issue in City source water quality, although, elevated levels of arsenic have been detected in two tributaries (RHR, UOR) in the Otay-Cottonwood System. A majority of the land area within source water boundaries has slopes of between 16% and 50% creating the likelihood of transport of soils and contaminants to water bodies (**Table 3.2**). In addition, dominant soil types are highly susceptible to erosion especially if the vegetation is disturbed (**Table 3.3**) or the hydrography is modified.

Dominant native vegetation types are well adapted to fire, drought tolerant and are not considered significant consumers of water. Wildlife species in general are not considered to be a significant source of contamination, although large residential populations of water fowl located at several source water reservoirs continue to be considered a minor source of bacterial contamination. The 2007 discovery of the aquatic invasive species *Dreissena bugensis* in the source water system has the

potential to significantly impact the ecosystems in source water reservoirs, and the infrastructure for the conveyance and treatment of source water increasing frequency and cost of maintenance.

Potential Contaminant Sources within the Local Source Water System

Urban Development throughout the entire source water system and agriculture primarily in the San Diego River and Hodges systems continue to pose the greatest potential concerns for chronic water quality degradation (**Tables 3.4, 3.5, 4.1, 4.2, 4.10**). These potential contamination sources include many nonpoint sources which are more difficult to control than point sources.

The greatest potential concerns for acute water quality degradation primarily include wastewater spills in the San Diego River and Hodges systems, and fires in the San Diego River, Otay-Cottonwood, and Hodges systems (**Tables 4.8, 4.9, 4.13**); particularly if the events are large, severe, or occur in sensitive areas.

- **Point Source:**
  1) Chemical spills at hazardous waste storage sites or along transportation corridors.
  2) Nutrients, pathogens, and organic matter from concentrated animal feeding operations.
  3) Nutrients, pathogens, organic matter, and gross pollutants from wastewater spills from collection systems, pump stations, and wastewater treatment facilities.

- **Non-point Source:**
  1) Sediment, nutrients, chemicals, and pathogens from residential and commercial development.
  2) Nutrients and pathogens from failing, older OWDS.
  3) Sediment and nutrients from agricultural areas.
  4) Sediment and nutrients from burned areas.

Assessment of Source Waters

- **San Diego River System**
  San Diego River System source water quality data indicates that constituents are typical of raw waters of Southern California. Mean values of TN from the majority of streams in the San Diego River System have decreased since the 2005 WSS, while little change was identified at the reservoirs. This same

trend was identified in mean values of most metal parameters. These reductions may be attributed to the recovery of the El Capitan and San Vicente Watersheds since the massive fires of 2003 which burned 94% of El Captain and 98% of San Vicente Watersheds.

Methyl t-Butyl Ether (MTBE) values decreased since the 2005 WSS to non-detect (ND); this may be attributed to its elimination as an oxygenator in gasoline in the San Diego area and equipping all rental boats on CSD reservoirs with 4-stroke motors replacing older 2-stroke motors.

- **Otay-Cottonwood System**
  Otay-Cottonwood System source water quality data indicates that most constituents are typical of raw waters of Southern California. Mean values of TN (5.47 mg/L) and arsenic (13 mg/L) have increased since the 2005 WSS. Data revealed that two streams, Rolling Hill Ranch (RHR2) and Upper Otay River (UOR1), were the sources of these increased levels (**Appendix 5**). Mean TN values for RHR2 and UOR1 are 18.18 mg/L and 5.23 mg/L respectively, while the other eight streams included in this survey had TN values ranging from 0.339 mg/L to 3.03 mg/L. Mean arsenic values for RHR2 and UOR1 are 19.95 mg/L and 12.57 mg/L respectively, while the other four streams included in this survey had mean arsenic values ranging from ND to 6.33 mg/L.

  RHR2 and UOR1are located north-west and terminate into Upper Otay Reservoir; a tributary reservoir to Otay Reservoir. The origin of the arsenic is believed to be the disturbance of the local volcanic rock in the surrounding Jamul Mountains from vigorous development. Subsequent urban runoff from the development initiated dry weather flow in the two tributaries in 2005.

  MTBE values, all ND, have continued to decline.

- **Miramar System**
  Miramar System source water quality data indicates that constituents are typical of raw waters of Southern California. Mean values of water quality parameters have experience little change since the 2005 WSS. MTBE values, all ND, have continued to decline.

- **Hodges System**

Hodges System source water quality data indicates little change in parameters since the 2005 WSS. As in the other systems, Hodges continued to see a decline in MTBE values, all ND, since the 2005 WSS.

Assessment of Regulatory Compliance

The review of source water and treated water quality data for the Alvarado, Otay and Miramar WTP's indicates the City is currently in full compliance with existing and pending regulatory requirements (**Chapter 5**). Influent water quality data for all three WTPs indicated increases in DBPs. These increases in TTHM, and to a lesser degree HAA-5 levels, can be attributed to the initiation of the addition of free chlorine to the imported source water in the summer of 2007 by MWD for *Quagga* mussel control.

Currently all three WTP's have undergone upgrades to meet the requirements of the Stage 2 Disinfectants and Disinfectant Byproducts Rule (D/DBP) and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), starting in 2012. Alvarado and Miramar WTP's have added ozone, while Otay WTP has added chlorine dioxide as primary disinfectants. A summary of existing and future regulatory requirements along with compliance status for all three WTP's is provided in Table 6.1.

Table 6.1 - **Summary of Compliance Status for Alvarado, Otay, and Miramar WTP's to Existing and Future Regulatory Requirements**

	Compliance Status		
Regulations	**Alvarado WTP**	**Otay WTP**	**Miramar WTP**
Surface Water Treatment Rule	Influent Data requires 0.5-log reduction for *Giardia* and 2-log reduction for viruses. All disinfection and turbidity removal requirements met.	Influent Data requires 0.5-log reduction for *Giardia* and 2-log reduction for viruses. All disinfection and turbidity removal requirements met.	Influent Data requires 0.5-log reduction for *Giardia* and 2-log reduction for viruses. All disinfection and turbidity removal requirements met.
Interim Enhanced Surface Water Treatment Rule (IESWTR)	Influent Data requires 2-log reduction credit for *Cryptosporidium.* All turbidity standards and filter performance requirements met.	Influent Data requires 2-log reduction credit for *Cryptosporidium.* All turbidity standards and filter performance requirements met.	Influent Data requires 2-log reduction credit for *Cryptosporidium.* All turbidity standards and filter performance requirements met.
Stage 1 Disinfectants/Disinfectants Byproducts Rule	TTHM/HAA5 RAAs in distribution system currently comply with drinking water standards.	TTHM/HAA5 RAAs in distribution system currently comply with drinking water standards.	TTHM/HAA5 RAAs in distribution system currently comply with drinking water standards.

Phase I, II and V SOC/IOC Regulations	No MCL's exceeded.	No MCL's exceeded.	No MCL's exceeded.
Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)	*Cryptosporidium* data placed Alvarado WTP in bin 1; no additional treatment required.	*Cryptosporidium* data placed Otay WTP in bin 1; no additional treatment required.	*Cryptosporidium* data placed Miramar WTP in bin 1; no additional treatment required.
Stage 2 Disinfectants/Disinfectants Byproducts Rule	Plant upgrade to ozone replacing free chlorine as primary disinfectant, compliance to Stage 2 D/DBP Rule expected.	Plant upgrade to chlorine dioxide replacing free chlorine as primary disinfectant, compliance to Stage 2 D/DBP Rule expected.	Plant upgrade to ozone replacing free chlorine as primary disinfectant, compliance to Stage 2 D/DBP Rule expected.
Perchlorate	All WTP effluent data non-detects (< 4 µg/L), under the MCL of 6 µg/L; future regulations pending	All WTP effluent data non-detects (< 4 µg/L), under the MCL of 6 µg/L; future regulations pending	All WTP effluent data non-detects (< 4 µg/L), under the MCL of 6 µg/L; future regulations pending
Lead and Copper Rule	Continued compliance expected.	Continued compliance expected.	Continued compliance expected.
Radionuclides	All raw water and WTP data below MCL's; continued compliance expected.	All raw water and WTP data below MCL's; continued compliance expected.	All raw water and WTP data below MCL's; continued compliance expected.
Arsenic	All WTP effluent data non-detects (< 2 µg/L) , under the MCL of 10 µg/L; future compliance expected	All WTP effluent data non-detects (< 2 µg/L) , under the MCL of 10 µg/L; future compliance expected	All WTP effluent data non-detects (< 2 µg/L) , under the MCL of 10 µg/L; future compliance expected
Ground Water Rule	Continued compliance expected.	Continued compliance expected.	Continued compliance expected.

6.2 Watershed Management and Control Practices

The City of San Diego owns about seven percent of the area within its local source water system boundaries, another three percent of the area fall within City limits; therefore, most of the area is outside the City's jurisdiction for land use planning, zoning, building codes, and enforcement of environmental regulations. Public ownership accounts for 58 percent of the area within the local source water system. This ownership pattern limits the control measures available to the City in the majority of area within the local source water system to monitoring land use and water quality

permit activities, along with coordination and communication with other agencies and stakeholders.

On CSD owned lands, land use and potentially polluting activities are monitored and controlled directly. The City exercises a number of management practices or controls primarily around source water reservoirs and their associated facilities such as:

- Bi-weekly area surveys including: condition of fencing, gates, locks, and signs, evidence of illegal off-road activity or dumping, signs of excessive erosion or obvious contamination of source water streams.
- Routinely scheduled water quality sampling and electronic profiling of source water streams and reservoirs (**Table 5.1**).
- Permitting and limiting public use of resources (**Table 4.12**).
- Exclusion from critical areas.
- Staff on site during periods of allowed public access.
- Available and maintained waste facilities including: trashcans, toilets, and “pack it in – pack it out” plastic trash bag dispensers.
- Annual maintenance of parking areas, roads, and storm drains including removal of weeds, litter, and debris.
- Use of lower emission four-stroke motors on city owned vessels; including rental fleet.
- Minimized on-site use and storage of hazardous materials.
- Weekly inspection of on-site hazardous material/waste containers and storage sites.
- Quarterly inspection of on-site spill-kits; including 300 feet of containment boom.

In 2007, 17 solar powered circulators (considered a 50% deployment) were installed In Otay Reservoir to aid with seasonally reoccurring taste and odor issues and oxidation of hypolimnetic compounds. 12 of the circulators (epilimnetic) were dedicated to taste and odor issues while the remaining five (hypominetic) to oxidation purposes. After evaluation, in 2010, the five hypolimnetic circulators were relocated and redeployed within the reservoir as data analysis showed them to be ineffective.

6.3 Recommendations

Local source water quality is critical to City efforts in the treatment of source water to meet required drinking water standards as efficiently as possible. The underlying theme of all recommendations is protection of the watershed and source water quality. Generally, the recommendations strengthen the first barrier to water

quality degradation; protection of the source. By strengthening the first barrier, impacts on the second barrier; water treatment, may be reduced.

The recommendations fall into three categories:

- Watershed Management and Control Practices
- Public Education
- Inter-jurisdictional Coordination

In areas under City jurisdiction, the City should:

- Continue to routinely survey, monitor, and limit the use of resources including: water quality, land conditions, and land use, with emphases to meet all regulatory requirements and efficiently obtain the necessary information to make evaluations on the water quality, identify trends in degradation, isolate sources of contamination, and determine effects of management practices. Initiate an acute event source water monitoring program for specific events (such as: rain, fires, and spills) that could directly impact the CSD local source water.
- Formulate a watershed land strategy to acquire parcels, conservation easements, or development rights for lands proximal to the source waters that, if preserved, would protect water quality.
- Continue public involvement and maintain established signage and public education material as to the importance of protecting the source water; ensure that it is readily available, accurate, and appropriate.
- Continued public outreach to promote awareness of quagga and zebra mussels, including personnel prevention activities, by providing signage, pamphlets, posters and other publications supplied CDFG at infested and non-infested reservoirs.
- Install additional signage at source water reservoirs to discourage the public feeding of animals.

In areas not under City jurisdiction, the City should:

- Continue to screen land use and water quality permit activities.
- Maintain public outreach signage installed in several transportation corridors to educate travelers and residents that they are currently within watershed boundaries and to help protect the resource.
- Maintain coordination with other agencies and stakeholders on issues regarding the potential impacts to local source water quality.
- Continue stakeholder participation in the Regional Quagga Mussel Working group.