Chapter 4 Table of Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

ACOE	Army Corps of Engineers
af	Acre-Feet
AGC	Associated General Contractors
ASCE	American Society of Civil Engineers
BANN	Builders Association of Northern Nevada
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
BOR	U.S. Bureau of Reclamation
CIP	Capital Improvement Program
CSWRF	Cold Springs Water Reclamation Facility
CWA	Clean Water Act
DO	Dissolved Oxygen
DRI	Desert Research Institute
DRP	Dissolved Reactive Phosphorus
ECS	Environmental Control Section
EPA	United States Environmental Protection Agency
ERA	Ecological Resource Associates
Focus Group	Truckee River WQS Focus Group
GIS	Geographic Information System
KJC	Kennedy Jenks Consultants
LA	Load Allocation
lbs	Pounds
LID	Low Impact Development
LVWRF	Lemmon Valley Water Reclamation Facility
MCL	Maximum Contaminant Level
mg/L	Milligrams Per Liter
MGD	Million Gallons Per Day
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer Systems
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NEMO	Non-point Education for Municipal Officials
NNWPC	Northern Nevada Water Planning Commission
NPDES	National Pollutant Discharge Elimination System
NTD	North Truckee Drain
NWRI	National Water Research Institute
O3-BAC	Ozone – Biological Activated Carbon
PAG	Professional Advisory Group
PLPT	Pyramid Lake Paiute Tribe
PM10	Particulate Matter
POTW	Publicly Owned Treatment Works
Reno	City of Reno

RIBs	Rapid Infiltration Basins
RO	Reverse Osmosis
RSWRF	Reno-Stead Water Reclamation Facility
RWMF	Regional Water Management Fund
RWPC	Regional Water Planning Commission
Sparks	City of Sparks
STMWRF	South Truckee Meadows Water Reclamation Facility
SVGID	Sun Valley General Improvement District
SWMP	Storm Water Management Program
SWPCC	Storm Water Permit Coordinating Committee
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
TMDLs	Total Maximum Daily Loads
TMSA	Truckee Meadows Service Area
TMSWMP	Truckee Meadows Storm Water Quality Management Program
TMWA	Truckee Meadows Water Authority
TMWRF	Truckee Meadows Water Reclamation Facility
TN	Total Nitrogen
TNC	The Nature Conservancy
TP	Total Phosphorus
TRHSPF	Truckee River Hydrological Simulation Program FORTRAN
TRIG	Truckee River Information Gateway
TROA	Truckee River Operating Agreement
TROM	Truckee River Operations Model
TSS	Total Suspended Solids
T-TSA	Tahoe-Truckee Sanitation Agency
U.S.	United States
UNCE	University of Nevada Cooperative Extension
UNR	University of Nevada, Reno
USFWS	U.S. Fish and Wildlife Service
WARMF	Watershed Analysis Risk Management Framework
WCHD	Washoe County Health District
WCSD	Washoe County Community Services Department
WLA	Waste Load Allocation
WQCP	Water Quality Control Plan
WQS	Water Quality Standards
WRWC	Western Regional Water Commission

Chapter 4 Wastewater and Watershed-Based Water Quality Planning

Purpose and Scope

This chapter provides background information as well as the current status of regional wastewater facilities and watershed based water quality issues. It also presents a number of planning and management issues that require action and/or further evaluation. These issues must be considered together with other water management planning objectives to determine appropriate future actions and recommendations.

Summary and Findings

Following are the major findings resulting from the analysis of water quality and wastewater treatment issues in the Planning Area.

Facilities
The five publicly owned wastewater treatment facilities in the Planning Area each process sewage at average daily flows below maximum capacities.

Effluent Management
The informal Regional Effluent Management Team is working toward regionally-based solutions to several near-term effluent management issues; acknowledging that the strategies developed may form the framework for an up-to-date regional effluent management master plan that will cover all of the Planning Area's publicly-owned water reclamation facilities and service areas.

Near-term effluent management issues focus on reducing nitrogen loading to the Truckee River by maximizing the use of Truckee Meadows Water Reclamation Facility ("TMWRF") reclaimed water at locations away from the river in allowable quantities and during appropriate times of the year, while maintaining a balance with Truckee River flows consistent with State water law and the Truckee River Operating Agreement ("TROA").

Expanded use of reclaimed water could include locations outside the Truckee Meadows Service Area ("TMSA") and uses such as groundwater recharge or indirect potable reuse. Such uses are being studied with respect to regulatory issues, treatment technologies and public perception.

The State of Nevada has approved "exceptional quality" standards for reclaimed water that will offer regional long-range water supply resiliency benefits. Criteria for exceptional quality reclaimed water, achieved through a series of advanced water treatment and natural processes, are included in State regulations to permit the use of reclaimed water for groundwater augmentation.

Septic Systems
The Septic Nitrate Baseline Data and Risk Assessment Study, Phase II prioritized nine areas (Mt. Rose, Ambrose, Hidden Valley, Huffaker, Verdi, Geiger, Island 18, Mogul, and Pleasant Valley) needing more in-depth analysis to fill data gaps identified in Phase I. Of 173 groundwater samples collected in 2014 and 2015 from domestic wells in the nine study areas, only two domestic wells, located in the Mt. Rose and Verdi areas, recorded nitrate levels above the maximum contaminant level ("MCL") of 10 milligrams per liter ("mg/L").

Samples collected from areas of known impact, but which had not been sampled for 10 to 20 years, including Washoe Valley, Cold Springs and Heppner subdivision in Lemmon Valley

confirmed past conclusions. Twenty-two of 83 samples from Washoe Valley were above the MCL and the highest was 50 mg/L. Of the 33 samples from Heppner, five were above the MCL with a high of 19 mg/L. In Cold Springs, none of the 17 samples were above the MCL.

In July 2016, the Washoe County Community Services Department ("WCSD") distributed approximately 5,000 informational letters to domestic well owners within or in the vicinity of each of the 12 Phase II study areas. The letters serve as a resource guide to educate homeowners on nitrate in groundwater and provide a summary of nitrate concentrations found within their study area.

Results of this study and previous studies point to the importance of septic system density, parcel size and distance to sensitive receptors.

Conversion of septic systems to a municipal sewer system appears to be the most reliable, albeit expensive, measure to mitigate nitrate contamination due to high densities of septic systems. Artificial groundwater recharge using fresh water injected into the aquifer, such as in Golden Valley, has also proven beneficial in improving water quality with respect to nitrate.

Watershed/Water Quality
Total nitrogen ("TN") and total phosphorus ("TP") water quality criteria for the Truckee River were developed by the Nevada Division of Environmental Protection ("NDEP") initially in the 1970s. The current standards were set in 1984.

In 1994, the NDEP established Total Maximum Daily Loads "(TMDLs") for TN and TP and total dissolved solids ("TDS") in the Truckee River.

The NDEP and the United States ("U.S.") Environmental Protection Agency ("EPA") agreed that a third-party review of the 1994 TMDLs is appropriate to determine whether the assumptions underlying the 1994 TMDLs remained valid, and to identify new scientific and technical information and/or changes in conditions and river operations that may warrant a different approach to addressing nutrient issues in the watershed. A third-party review was initiated in the mid-2000s

In 2015, the Pyramid Lake Paiute Tribe ("PLPT") conducted a Triennial Review of water quality standards ("WQS") and presented rationale for proposed changes to certain standards, including a significant change to the dissolved reactive phosphorus ("DRP") criterion for the Truckee River, reducing it from 0.05 mg/L to 0.022 mg/L. The proposed reduction of the DRP criterion for the Truckee River was implemented in 2015.

Considering the revised PLPT DRP criterion, it is highly unlikely that the NDEP TP criterion would be revised to a value higher than the PLPT criterion because WQS from upstream jurisdictions must maintain compliance with WQS for downstream jurisdictions. To date, the third parties have taken no further action concerning the review of the NDEP TMDLs.

The current Storm Water National Pollutant Discharge Elimination System ("NPDES") permit was issued to the City of Reno ("Reno"), the City of Sparks ("Sparks") and Washoe County on May 26, 2010. A renewed permit is expected in 2017.

The Truckee Meadows Storm Water Permit Coordinating Committee ("SWPCC"), established among Reno, Sparks and Washoe County by interlocal agreement, is responsible for permit compliance. The purpose of the committee is to define responsibilities and funding options for

implementing the required components of the permit, and to submit annual reports to the NDEP and the EPA.

Based upon conversations with the NDEP and observations of national regulatory trends, the SWPCC anticipates that there will be a waste load allocation ("WLA") assigned to Truckee Meadows storm water in the future.

Introduction

Regional wastewater treatment facilities provide an effective means to manage the area's water resources and meet water quality objectives. The treated effluent, or reclaimed water, meets high WQS, and is returned back into the environment. Reno and Sparks have each created Environmental Control pretreatment programs which further protect the integrity of the large wastewater treatment systems. Reclaimed water irrigation programs are underway in Sparks and Reno, and additional areas of unincorporated Washoe County. Reclaimed water use provides a predictable way to manage effluent, and provides a relatively drought-proof alternative water supply for non-potable uses, thereby extending the region's limited water resources.

The Truckee River and its tributaries face water quality challenges, and varied regulations have been set forth by the Clean Water Act ("CWA") to protect water quality and the watershed. In addition to receiving treated effluent from the TMWRF and an upstream California facility east of Truckee, the Truckee River carries snowmelt, rainwater and urban storm water – each of which may carry diffuse sources of pollutants, such as suspended sediment or dissolved solids. These diffuse sources are referred to as non-point source pollution. Treatment plant discharges (point sources) and non-point sources have the potential to impair water bodies and therefore are regulated by the NDEP and the EPA to protect water quality.

In efforts to manage non-point sources entering the river, restoration projects in the Truckee River watershed have been funded and planned, and several have been implemented. A prioritized list of lower Truckee River restoration projects are in various stages of completion and monitoring. Tributaries to the Truckee River have also been assessed to prioritize stream restoration efforts. Reno, Sparks, and Washoe County jointly hold a federal NPDES permit to manage urban storm water quality and have signed an MOU for joint protection of the Truckee River watershed.

4.1 Wastewater Service Providers

Residential and commercial/industrial wastewater services are provided by four public entities in the Planning Area.

Reno provides wastewater collection, treatment and disposal services to its customers in the Truckee Meadows, Verdi and Stead/Lemmon Valley areas. Flows in the Truckee Meadows, Verdi and a small portion of Lemmon Valley are conveyed to the TMWRF, owned by Reno and Sparks. The majority of Reno's customers in Lemmon Valley are served by the Reno-Stead Water Reclamation Facility ("RSWRF").

Sparks provides wastewater collection, treatment and disposal services to its customers in the Truckee Meadows and Spanish Springs areas, and conveys flows to TMWRF.

The Sun Valley General Improvement District ("SVGID") provides wastewater collection within its boundaries, which covers the majority of the Sun Valley hydrographic basin. Wastewater flows are conveyed to Reno's collection system for treatment and disposal at TMWRF.

Washoe County provides wastewater collection, treatment and disposal services to its customers in the south Truckee Meadows area where flows are conveyed to the South Truckee Meadows Water Reclamation Facility ("STMWRF"). The STMWRF also provides treatment for portions of Reno's service area in the south Truckee Meadows. Washoe County also provides collection, treatment and disposal serves to its customers in Lemmon Valley using the Lemmon Valley Water Reclamation Facility (LVWRF"); and in Cold Springs using the Cold Springs Water Reclamation Facility ("CSWRF"). In addition, Washoe County provides wastewater collection to its customers in the Spanish Springs area where wastewater flows are conveyed to Sparks' collection system for treatment and disposal at TMWRF.

Figure 4-1 depicts each entity's service area and major collection system infrastructure, in addition to wastewater treatment facilities within the Planning Area. These facilities are described in Sections 4.2.

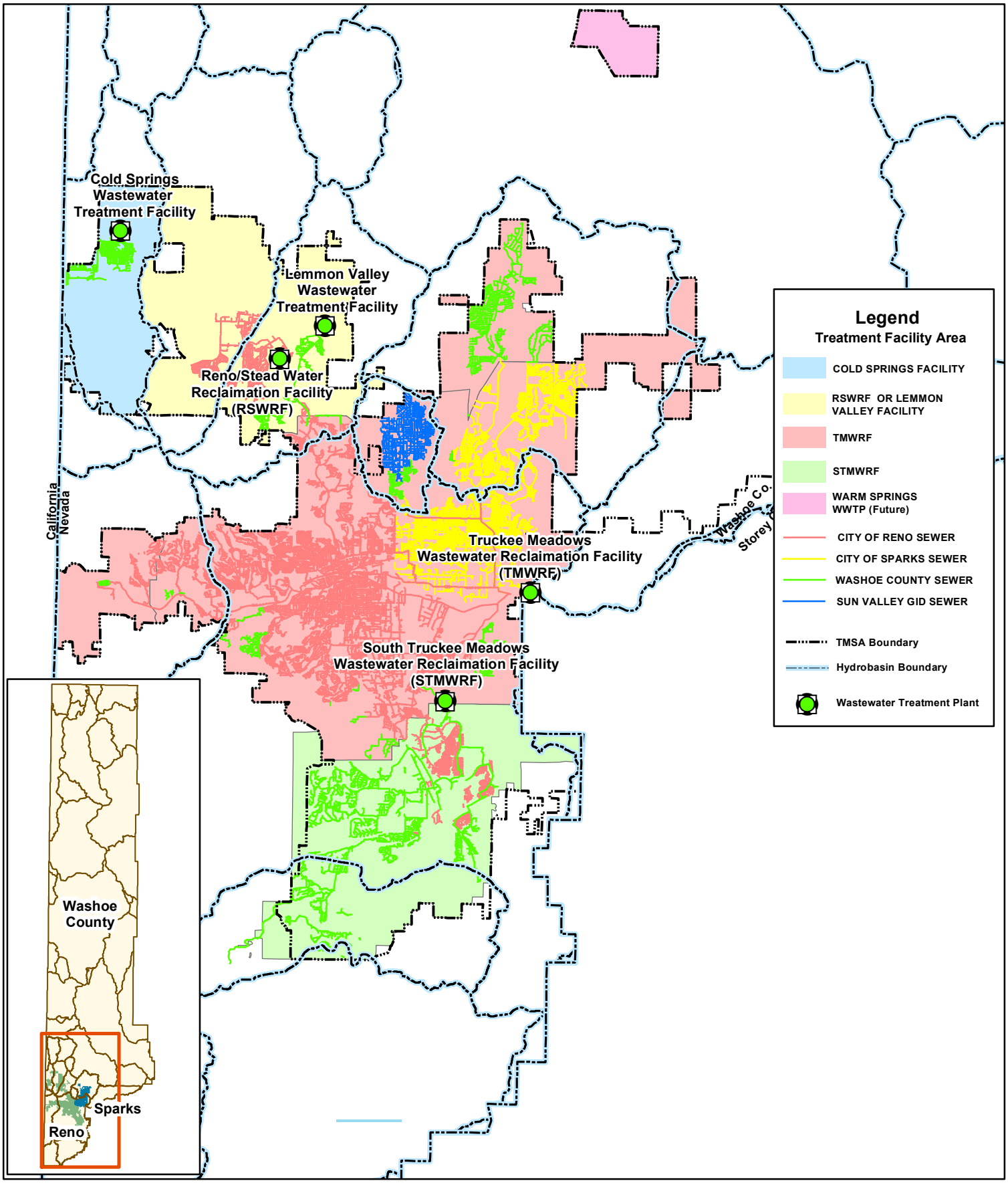

Figure 4-1 Water Reclaimation Facilities with Approximate Service Areas

0 1 2 3 4 5 Miles

Department of Water Resources

Notes: The Scale and configuration of all Information shown heron are approximate only and are not intended as a guide for design or survey work. Reproduction is not permitted without prior written permission from the Washoe County Department of Water Resources.

March 2016

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4.2 Water Reclamation Facilities

Regional wastewater treatment facilities provide an effective means to manage the area's water resource and achieve water quality objectives. The water is treated to high standards, and returned back into the environment for beneficial use. Additionally, reclaimed water programs are underway in Sparks and Reno, and additional areas of unincorporated Washoe County. Reclaimed water use provides a predictable way to manage treated effluent, and provides a relatively drought-proof alternative water supply, thereby extending the region's limited water resources. Careful consideration must be given to the balance between the need for reclaimed water to meet disposal requirements and the water rights needed to implement the reclaimed water programs. Section 3.5 describes the current status of reclaimed water use within the Truckee Meadows. Table 4-1 and the following sections describe each of the water reclamation facilities in more detail.

Table 4-1 Wastewater Treatment Facilities

Facility	2015 Average (Permitted) Daily Flow	Hydrographic Basin	Owner	Comment
Truckee Meadows Water Reclamation Facility	26.3 MGD* (44 MGD)	Truckee Meadows, Sun Valley, Spanish Springs Valley, Truckee Canyon	Cities of Reno / Sparks	Discharges to the Truckee River via Steamboat Creek, with effluent reuse
South Truckee Meadows Water Reclamation Facility	3.1 MGD (4.1 MGD)	Truckee Meadows, Pleasant Valley	Washoe County	100% reuse of effluent
Reno-Stead Water Reclamation Facility	1.4 MGD (2.0 MGD)	Lemmon Valley	Reno	Wetlands enhancement, with effluent reuse
Lemmon Valley Wastewater Treatment Plant	0.20 MGD (0.3 MGD)	Lemmon Valley	Washoe County	Evaporation ponds provide deep water wildlife habitat
Cold Springs Wastewater Treatment Facility	0.30 MGD (0.70 MGD)	Cold Springs Valley	Washoe County	Rapid infiltration basins

* Minor discrepancies may exist between influent flow measured at headworks and flow measured at effluent pump station. Any discrepancies are within industry standards.
MGD = million gallons per day

4.2.1 Truckee Meadows Water Reclamation Facility

TMWRF is a 40 million gallons per day ("MGD") regional wastewater plant serving the majority of the Truckee Meadows. The facility is located on the east side of the Truckee Meadows, at the confluence of Steamboat Creek and the Truckee River. TMWRF serves all of the Sparks, Spanish Springs, Sun Valley, and that portion of Reno north of Holcomb Ranch Road and South of Golden Valley. Additionally, TMWRF receives and treats biosolids from the RSWRF and is the only

treatment plant in the TMSA that receives septage. The TMWRF service area is shown on Figure 4-1.

The Reno and Sparks jointly began construction of TMWRF in 1964 and the facility began operation in 1966 as a 20 MGD secondary treatment plant. The first major expansion of TMWRF occurred in 1978 when phosphorus removal was added and the hydraulic capacity was increased to 30 MGD. Subsequent expansions in the mid-1980s added nitrification-denitrification processes, filtration and effluent reuse. This increased the hydraulic capacity of TMWRF to 40 MGD. The next plant expansion, begun in 1999, added two additional nitrification towers and additional aeration basins to bring TMWRF to its current hydraulic capacity of 46.5 MGD.

TMWRF currently treats approximately 26 MGD of wastewater to a stringent tertiary standard. In addition to the common biological oxygen demand and total suspended solids ("TSS") removal requirements, TMWRF is subject to three TMDL restrictions. These TMDLs limit the amount of TN, TP and TDS that may be discharged to the Truckee River. The TN limitation of 500 pounds ("lbs")/day is currently the limiting factor for treatment at TMWRF.

TMWRF diverts approximately 4500 acre-feet (af) of treated effluent annually for use as irrigation and industrial process water. This effluent is treated to the same level as the water that is discharged to the Truckee River, but is diverted prior to discharge to the effluent reuse system. This diversion occurs largely between April and October although there is some minor year-around effluent reuse.

Beginning in 2012 an aggressive Capital Improvement Program ("CIP") was implemented to identify and replace process equipment that was at the end of service life. The CIP is addressing the electrical power distribution system, various pumping and piping systems, HVAC, clarifiers and other equipment that requires refreshing to continue reliable service.

In 2014, an energy service project was implemented to address areas that required improvements but that would also provide identifiable cost savings for the facility. This project replaced low efficiency lighting, added a new digester gas co-generation engine, new dewatering centrifuges and an Ostara Nutrient Recovery System. This project is expected to save approximately $1.1 million per year in operating costs for the facility and will be completed in 2017.

The major emphasis of the current CIP in the next five years is to rehabilitate or replace equipment and infrastructure throughout the facility that is approaching the end of its useful and reliable service life. The planning portion of the CIP continues to evaluate new technologies that could assist the facility in more efficiently meeting discharge permit requirements and could potentially increase the facility's future treatment capacity. Additional master planning and improvements are anticipated as the facility flows and constituent concentrations continue to increase, and to meet regional growth projections.

TMWRF is jointly owned by Sparks (31.37 percent) and Reno (68.63 percent). An interlocal agreement was implemented in 1980 that defined the operation of the facility. Sparks operates the plant and all facility staff are Sparks employees. Reno manages the CIP for the facility. The facility's operational and capital improvement budgets are approved by the Joint Coordinating Committee, also created by interlocal agreement and comprised of elected and appointed representatives from both cities.

Pretreatment Programs

Reno and Sparks each maintain a pretreatment program which protects the wastewater treatment infrastructure. These programs are applied to the entire TMSA which includes SVGID and other unincorporated areas of Washoe County. The Cities have an agreement to perform pretreatment services for Washoe County, work with Washoe County on spill identification, response and disposal, and lastly protect all waterways from illicit discharges, including illicit discharges from irrigation ditches.

The term "pretreatment" refers to federal, state and local requirement that non-domestic sources discharging wastewater to publicly owned treatment works ("POTW") control their discharges and meet discharge limits established by the EPA (40 Code of Federal Regulations Part 403). The program is federally mandated for municipalities processing wastewater with a flow greater than five MGD. The purpose of the federal pretreatment program is to protect wastewater treatment facilities from receiving incompatible waste streams that may cause inhibition, interference or pass through of contaminants resulting in pollution of the receiving stream; in this case the Truckee River. The control of pollutants may require treatment prior to discharge to the POTW, hence the term "pretreatment". The term POTW refers to the sewers, pipes, lift stations and conveyances to the treatment plant and includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage.

Reno Environmental Control and Pretreatment Program

Reno's pretreatment program (Reno Municipal Code 12.16) is designed to reduce the level of pollutants discharged by industry and other non-domestic wastewater sources into municipal sewer systems and, thereby, reduce the amount of pollutants released into the environment. The objectives of the pretreatment program are to protect the POTW from pollutants that may interfere with treatment plant operations, protect personnel working for the POTW, prevent the pass through of pollutants into the environment and to improve POTW opportunities for the beneficial reuse of sewer effluent and bio-solids.

Reno Environmental Control has staff on-call 24 hours every day to respond to sewer overflows, illicit sewer and storm drain discharges, hazardous material spills and other environmental emergencies. Staff works with the Reno Fire Department, Reno Police Department, Reno Public Works Department, RSWRF, TMWRF, Washoe County Health District ("WCHD"), private contractors, and the NDEP to mitigate such emergencies.

Sparks Environmental Control and Pretreatment Program

In 1977, TMWRF received approval from the EPA for the first Wastewater Pretreatment program in the nation. Sparks Environmental Control Section ("ECS") staff performs a variety of duties to protect TMWRF and the municipal separate storm sewer systems ("MS4"). Staff members guide the industrial and residential community in the proper handling, treatment and disposal of wastes that may be incompatible with the environment. In the industrial community this is accomplished through on-site inspections and issuance of a Wastewater Inspection Certificate containing pretreatment requirements and Sparks waste water regulations (Sparks Municipal Code 13.33). Wastewater sampling is routinely conducted on industrial users' waste streams to insure compliance. Notices of Violation and Misdemeanor Citations are issued for non-compliance of discharge limits as well as other infractions of Sparks wastewater regulations and federal regulations.

Additionally, the Sparks ECS staff maintains a 24-hour spill hot line. Staff and equipment are available 24 hours a day to respond to any incident that may threaten the sanitary or storm sewer systems. The ECS protects the environment and serves the local community while being equitable and sensible in all situations.

4.2.2 South Truckee Meadows Water Reclamation Facility

The WCSD manages the County-owned STMWRF. Located at the southern base of the Huffaker Hills and originally constructed in 1991, STMWRF is a tertiary treatment facility. The facility is presently permitted for 4.1 MGD (influent flow, 30-day average), expandable to at least 6 MGD. STMWRF current influent flow is approximately 3.0 MGD.

The treatment process consists of influent pumping, fine screening, metering, and secondary treatment by oxidation ditch process combined with four conventional secondary clarifiers for solids separation. Filteration and disinfection achieve reclaimed water meeting State of Nevada Category A standards. Reclaimed water is stored year-round in the Huffaker Reservoir, and used for irrigation water. Huffaker Reservoir has a storage capacity of 4,000 af, and was recently improved with a partial membrane liner to create 2,000 af of impermeable storage. Waste solids are aerobically digested, dewatered and disposed at the Lockwood Regional Landfill.

Improvements in wastewater collection system infrastructure consist principally of expansion of sewer interceptors, particularly those serving the Galena Fan area. A future sewer interceptor alignment that will follow U.S. 395 south through Pleasant Valley is envisioned.

An updated 20-year facility plan was completed in 2016 with assistance from Carollo Engineers. A capital improvement plan, identifying sanitary sewer interceptor and wastewater treatment improvements was also produced. The plan identifies improvements needed for repair and replacement, upgrades due to meet permit requirements, and additional capacity for anticipated growth. Approximately $60 million of infrastructure improvements is identified, which will be phased over the next 20-year planning period. CH2M Engineers assisted Washoe County to prepare a complimentary 20-year facility plan looking specifically at the South Meadows reclaimed water system improvements. Approximately $34 million of reclaimed water transmission piping, water storage and treatment facilities are identified.

4.2.3 Reno-Stead Water Reclamation Facility

The RSWRF is located in Stead and is owned and operated by Reno. It serves the area of Stead within the Reno city limits on the west side of Lemmon Valley, including the Stead Airport and Silver Lake areas as shown in Figure 4-1. In 1974, Reno replaced the original trickling filter plant with an activated sludge plant. The plant was modified in 1987 to improve the secondary clarification and effluent disinfection processes and in 1994, the sludge drying beds were replaced with centrifuge dewatering. The plant was upgraded in 2000 to provide high quality effluent for reuse purposes. With another round of improvements in 2006 Reno expanded treatment capacity to 2.0 MGD and transformed the RSWRF into a state of the art wastewater treatment and water reclamation facility. The improvements included a new headworks, new aeration basins and blower building, an additional secondary clarifier, activated sludge pump station improvements, conversion of the oxidation ditch to an emergency storage basin, new tertiary filter equipment, and a new solids handling and disposal system. Waste solids are now pumped to TMWRF for final treatment and disposal.

The RSWRF has the capacity to treat an annually averaged monthly flow of 2.0 MGD. Average daily flows are approximately 1.4 MGD. Treated effluent either discharges by gravity to Swan

Creek, which drains to the Swan Lake wetlands, or it is reclaimed and pumped to several sites within the community for turf irrigation. Reclaimed water is also available for purchase at the RSWRF truckfill station. This water is used primarily for construction/dust control. All reclaimed water is disinfected to meet the Total Coliform Standard for unrestricted reuse. The reclaimed water typically carries a residual chlorine concentration of one mg/L. A permit modification in 2014 allowed for discontinuation of dechlorination prior to discharge to the creek. Of the approximately 1,500 af per year of wastewater flowing into RSWRF, approximately 1,000 af is released to Swan Creek, and approximately 500 af is provided to the reclaimed water system. The City has committed 490 af a year to Swan Lake itself.

4.2.4 Lemmon Valley Water Reclamation Facility

The LVWRF is located in East Lemmon Valley at the southeast end of Swan Lake and is owned and operated by Washoe County. It currently serves 1,100 homes within East Lemmon Valley, Black Springs, and Horizon Hills. It is a secondary treatment plant and was built in 1971. It currently processes 0.26 MGD and has a permitted capacity of 0.3 MGD.

The treatment plant consists of a grit well, comminutor, wet well pump station, contact stabilization tank, secondary clarification, and aerobic sludge digestion. Effluent is discharged to evaporation ponds, including a 0.65 MGD discharge allowed to the Swan Lake playa for water balance management. The facility does not have an effluent reuse program. Digested solids are sent to sludge-drying beds or to solids ponds during wet weather months.

An infrastructure facility plan is presently being conducted in collaboration with Reno and assisted by Stantec Engineering. In early 2017, it is anticipated Reno and Washoe County will complete a joint facility plan for the combined sanitary sewer service areas of RSWRF and the LVWRF.

4.2.5 Cold Springs Water Reclamation Facility

Washoe County also owns and operates the CSWRF, a secondary treatment plant located in the northern portion of Cold Springs Valley. The plant currently serves approximately 1,800 homes, and the average daily influent flow is about 0.35 MGD. Permitted capacity is 0.70 MGD.

The CSWRF consists of a headworks, oxidation ditch, and two secondary clarifiers. Secondary treated effluent is denitrified and disposed of at 12 rapid infiltration basins (“RIBs”), which range in size from 1.2 to 2.1 acres. With these recent upgrades, reclaimed water may be used onsite and for irrigation at approved sites in the near future. Additionally, plant capacity may be expanded to 1.2 MGD by adding another oxidation ditch when growth requires it. In the past, sludge was dried in lined sludge lagoons. Presently, the three original SBR basins are used for waste solids, which are aerobically digested, dewatered and transported to the Lockwood Regional Landfill.

An infrastructure facility plan is presently being conducted in collaboration with Reno and developers, with assistance from Farr West Engineering. The developers involved represent several development projects presently in the planning process. The facility plan will be completed by the end of 2016.

4.3 Regional Effluent Management Planning

The use of reclaimed water from the various water reclamation facilities in the Planning Area may eventually be constrained by one or more factors, which could include compliance with existing or future WQS, lack of future reclaimed water customers, insufficient winter storage and/or

conveyance infrastructure. Regional water management challenges in the Planning Area include such complex, integrated issues as:

- Ensuring that the existing wastewater treatment plants are prepared to meet existing nutrient limitations in the face of anticipated growth;
- Ensuring that the responsibility to meet any new WQS that affect receiving waters are shared by all entities contributing to the poor water quality;
- Ensuring sustainable water supplies and infrastructure to meet the needs of existing customers, and future demands within and outside the TMSA (same as first bullet);
- Providing appropriate water quality and treatment capacity at various wastewater treatment facilities;
- Providing for adequate reclaimed water demands, reclaimed water system capacity and effluent disposal capacity; and
- Addressing competing needs for the limited water resources available in the Planning Area to meet commitments to water supply, water quality, instream flows and the environment.

In 2008, the Northern Nevada Water Planning Commission ("NNWPC") and Western Regional Water Commission ("WRWC") initiated a collaborative effort among key staff from Reno, Sparks, Washoe County, SVGID and the Truckee Meadows Water Authority ("TMWA") to develop recommendations to address effluent management issues in the Planning Area, using circumstances that existed in the North Valleys at that time: a high growth rate, high population growth projections, planned water importation and an abundance of undeveloped land uses and zoning. Staff concluded that, if the region is going to spend the same amount of money for water and wastewater infrastructure, regardless of effluent disposal or reuse methods, the region should make the investment that maximizes the benefits provided by the available water resources.

Enhanced Nitrogen Removal Planning Study

In 2013, following an upset at TMWRF resulting in a nitrogen discharge violation, the WRWC funded the Enhanced Nitrogen Removal Planning Study conducted by Carollo Engineers. The final Technical Memorandum prepared for Reno identified three treatment technologies, one of which may be selected to supplement existing nitrogen treatment at TMWRF: enhanced coagulation; advanced oxidation; and reverse osmosis ("RO"). Additional evaluations of enhanced nitrogen removal technologies are ongoing.

Although TMWRF operations have been smooth with no upsets since the 2013 violation, discharge limitations for nitrogen may present significant compliance challenges as wastewater flows and/or strength increase over time. Of the three enhanced nitrogen removal treatment technologies studied by Carollo, RO has the advantage of removing not only nitrogen, but phosphorus, TDS and other compounds that may be of concern in the future. Disadvantages include a concentrate (brine) stream generated by RO treatment consisting of approximately 10-15 percent of the feed flow. Water reclamation facilities in coastal locations typically use ocean discharge for concentrate disposal, but inland facilities must develop alternative management strategies. Options for the management and disposal of reject concentrate from the RO treatment process have not been investigated. This topic was not within the scope of the Carollo study, which assumed deep-well injection for concentrate disposal. Enhanced coagulation and advanced oxidation have a greater viability in this region because there is no brine stream

requiring disposal. Both technologies are relatively expensive however, requiring significant energy and/or chemical addition.

In December 2014, the NNWPC directed staff to summarize wastewater master planning in the Planning Area and outline a scope of work for a wastewater and effluent management master plan update. Technical staff from Reno, Sparks, Washoe County and the TMWA had been meeting to discuss regional effluent management issues since April 2014, and welcomed NNWPC participation. This informal group is generally referred to as the "Regional Effluent Management Team" (the "Team"). The Team is working toward regionally-based solutions to several near-term effluent management issues; acknowledging that the strategies developed may form the framework for an up-to-date regional effluent management master plan that will cover all of the Planning Area's publicly-owned water reclamation facilities and service areas.

The near-term effluent management issues focus on reducing the nitrogen load to the Truckee River by maximizing the use of TMWRF reclaimed water at locations away from the river in allowable quantities and during appropriate times of the year, while maintaining a balance with Truckee River flows consistent with State water law and TROA. A variety of alternatives and scenarios are being evaluated using population and employment growth projections to estimate wastewater flow increases over time. The Team is taking steps to ensure a thorough understanding of the complex implications for effluent management scenarios before making any recommendations.

Scenarios being evaluated include:

- Developing a year-round reclaimed water demand, possibly outside the TMSA and/or infiltration to groundwater;
- Constructing an intertie pipeline, between TMWRF and Huffaker Reservoir, located at STMWRF, allowing for seasonal storage of TMWRF effluent and greater flexibility for reclaimed water use; and
- Demonstrating advanced water treatment technology consistent with revisions to State regulations concerning "exceptional quality" recycled water standards.

Water Balance Scenario Evaluation Using Linear Optimization Programming

Desert Research Institute ("DRI") is using a linear optimization model to compare strategies for distributing effluent between TMWRF and STMWRF to meet customer demands while minimizing the nitrogen load to the Truckee River. DRI's scope of work includes an evaluation of strategies and constraints including:

- A proposed intertie pipeline to connect TMWRF and STMWRF/Huffaker Reservoir using the Southeast Connector Roadway Project right of way;
- Existing customer effluent demands;
- Future effluent demands including potential large volume customers possibly outside the TMSA;
- RIBs; and
- Water rights constraints.

Initial findings from the evaluation include the following:

- Annualized use of effluent is beneficial for reducing nitrogen loading to river.
- Huffaker Reservoir provides a cushion in the event of a plant upset at TMWRF and off-season storage of TMWRF effluent.
- TRI Center demands were used in the model as a surrogate for other potential year-round demands such as RIBs, other large industrial uses, and/or groundwater replenishment.
- Intertie pipeline and proposed large-volume industrial users could provide a firm demand for future TMWRF and STMWRF effluent.
- STMWRF effluent provides water with no additional return flow water rights requirement.

Ongoing DRI modeling simulations continue to refine the evaluation of the intertie pipeline, in addition to the feasibility of various industrial deliveries for current and future scenarios through 2034. The model has been updated to reflect new information, including STMWRF effluent demand projections, seasonal industrial demands and the addition of a 1,400 AF effluent storage reservoir.

One of the key considerations of the current evaluation involves the effluent return flow requirement for the Truckee River. The model tracks TMWA's groundwater and surface water production during both drought and normal years to estimate the seasonal groundwater component of the effluent. Taking the results from the DRI model, the Team will consider the groundwater component, Water Quality Settlement Agreement water rights, and other surface water resource options to ensure that the effluent return flow component is satisfied under varying demand and hydrologic conditions, consistent with TROA operations.

The model results will provide decision makers with the technical information to consider whether the intertie pipeline and/or a year-round effluent demand such as industrial uses and/or groundwater replenishment is a sound long-term strategy for TMWRF to reduce nitrogen loading to the Truckee River.

Exceptional Quality Reclaimed Water Feasibility Study

The Team is jointly developing a feasibility study to evaluate whether the State of Nevada's "exceptional quality" standard for reclaimed water offers regional long-range water supply resiliency benefits. Criteria for exceptional quality reclaimed water, achieved through a series of advanced water treatment and natural processes, are included in State regulations to permit the use of reclaimed water for groundwater augmentation. The Team envisions a five-year feasibility study that consists of multiple elements including social, environmental and financial analyses, regulatory compliance, public engagement, advanced treatment pilot testing, geotechnical investigations, and field scale treatment demonstration projects.

A growing number of national and international communities have developed advanced-treatment reclaimed water projects as an efficient use of water resources. Projects defer expenditures on future water importation projects, provide a local drought proof water supply, and provide for a more resilient total water management strategy. Within the water sector, projects using advanced treatment for reclaimed water are typically referred to as potable reuse projects. While the Team seeks to develop a more comprehensive assessment through a demonstration-scale groundwater replenishment project, there is no current plan to augment local potable water supplies at full

scale. A panel of international water reuse experts is guiding the Team's feasibility phase activities.

The advanced water treatment investigations will be conducted over the next three to four years, led by researchers at University of Nevada, Reno ("UNR"). UNR will develop the technological justification for selecting the advanced water treatment systems; establish the field scale demonstration project design basis and testing plan; assist acquiring the necessary water treatment equipment; assist during the installation of the demonstration project; conduct startup of the treatment facility, optimizing the treatment unit processes; perform monitoring and testing of the operating strategies, process control, and performance parameters during steady state operations; analyze data, and prepare a final report.

Technological options considered for advanced treatment of reclaimed water to meet drinking water standards include an RO based treatment train and a biological filtration based treatment train. The former has the distinct disadvantage of side-stream RO brine disposal, which is a challenge for inland regions. Therefore, to meet the study goals, the reclaimed water will also be treated through a series of advanced water treatment and natural processes, likely including biological activated carbon filtration, advanced oxidation, ultra-violet disinfection, and soil aquifer treatment. A further review of the applicability of this treatment compared with other alternatives will be explored during the initial stages of this project.

Advanced water treatment technology has been studied locally in the recent past. From 2008-2010 Reno supported WateReuse Research Foundation Project 08-04 to investigate Ozone – Biological Activated Carbon ("O3-BAC") as an advanced water treatment alternative to reverse osmosis. The results demonstrated O3-BAC as a viable method for potable reuse. Presently, the regional agencies are supporting WateReuse Research Foundation Project 15-10, which is intended to look more closely at optimal O3-BAC operating conditions. Following an approximately six-month project scoping and review phase that began in January 2016, it is envisioned that pilot operation will occur over a nine-12-month period. Water Reuse Research Foundation ("WRRF") 15-10 project is being jointly funded by WRRF, American Water, and Stantec Consulting. The pilot unit will be located at the STMWRF.

Expert Panel

A panel of international water reuse experts (the "Panel"), managed by the National Water Research Institute ("NWRI") with general guidance from the Team is helping to develop feasibility phase goals and a work plan, providing critical review concerning work progress and making regular recommendations. Jeff Mosher, NWRI Executive Director, an established water expert, is the primary point of contact. The Panel is comprised of members with expertise in all aspects of potable reuse project implementation, including regulatory, public heath, public engagement, advanced water treatment technologies, and groundwater hydrogeology. Panel members are also helping to craft an opportunity statement unique to the Truckee Meadows to help align the feasibility phase activities and more clearly articulate the project purpose to policy makers and the community.

The Panel will be supported by an advisory committee comprised of State and local public health, planning, regulatory, and water utility agencies. The following organizations have been identified as likely advisory committee participants:

- NDEP;
- Nevada State Health Division;
- NNWPC;
- Reno;
- Sparks;
- TMWA;
- TMWRF;
- University of Nevada Reno;
- Washoe County Community Services Department;
- WCHD; and
- Desert Research Institute.

Geotechnical Investigations

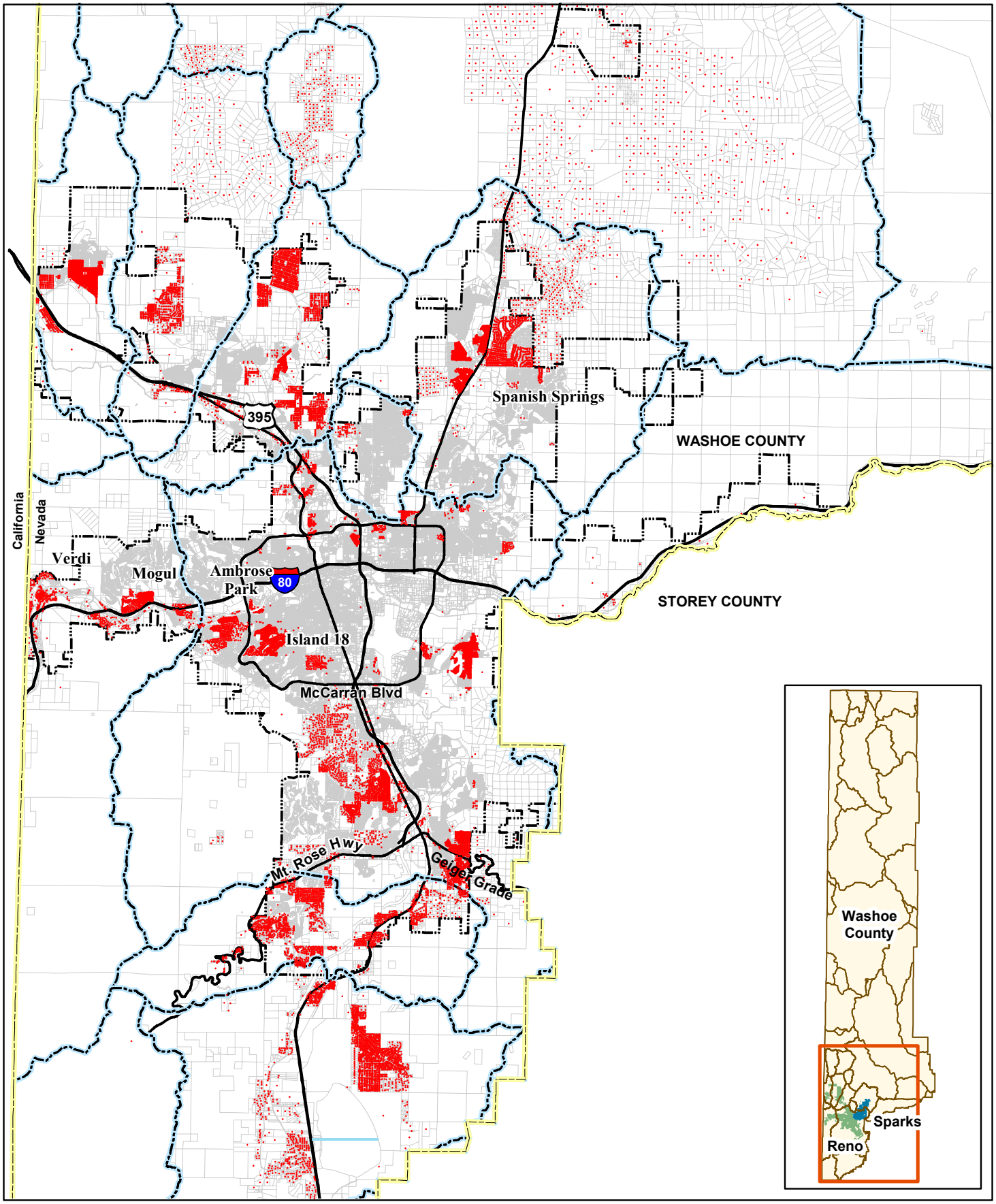
A main component of the demonstration project is to physically analyze aquifer recharge potential through either an infiltration basin and/or injection wells. Potential sites under consideration include Stead/Lemmon Valley, Cold Springs and Bedell Flat. Classifying hydrogeologic characteristics through groundwater modeling and borehole investigations will assist with sizing the demonstration project advanced treatment units as well as determining the suitability of aquifer recharge at each potential site.

4.4 Septic Systems

The cumulative effect of septic systems on surface waters is difficult to calculate or measure. It may take years to begin detecting increased pollutant loads in surface water resources. Because groundwater quality is protected to drinking water standards, which are commonly less restrictive than aquatic life criteria that apply to creeks and rivers, protection of groundwater quality to the level of the drinking water standards may not provide adequate protection to nearby surface waters. There is concern that this situation may potentially exist in the Verdi, Spanish Springs, Mogul, Ambrose Park, and Island 18 areas (Figure 4-2). In areas where there is little groundwater recharge, effluent from septic systems can recycle through the groundwater system, potentially increasing pollutants to unacceptable levels.

In some areas of Washoe County, the number of allowable septic systems has been limited based on an analysis of the potential impacts to water quality. One such area is Verdi, where the Washoe County Comprehensive Plan allows a maximum of 1,300 septic systems (Washoe County, 2002).

Washoe County has identified areas of groundwater quality degradation as a result of septic system effluent, occurring predominantly in areas with high septic system densities. In addition to high densities, contributing factors to water quality degradation include shallow depths to ground water, permeable soil conditions, and proximity to sensitive receptors, such as water supply wells, creeks, rivers, and lakes. These conditions are present in Spanish Springs Valley, Golden Valley, Washoe Valley and Lemmon Valley. In Spanish Springs Valley, 15 years of groundwater quality monitoring have shown increasing levels of nitrate contamination in municipal wells. Almost 2,000 septic systems are located within a four square-mile area, with almost half of these systems within 2,000 feet of one or more municipal water supply wells. Two of six municipal wells in the highly developed portion of Spanish Springs Valley have nitrate concentrations at or approaching the drinking water standard of 10 mg/L nitrate as N, and their use has been discontinued.



Parcel on Septic

TMSA Boundary

Hydrobasin Boundary

Figure 4-2 Parcels Served by Septic Systems

0 1 2 3 4 5 Miles

Notes: The Scale and configuration of all Information shown heron are approximate only and are not intended as a guide for design or survey work. Reproduction is not permitted without prior written permission from the Washoe County Department of Water Resources.

October 2010

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Using knowledge of these areas, especially Spanish Springs Valley, Washoe County expanded the scope of a septic system effluent investigation throughout the densely populated portions of Washoe County. The study was titled *Phase I: Prioritization of Study Areas & Assessment of Data Needs* (WCDWR, 2007). The goals of the study were to investigate the potential for nitrate contamination in the metropolitan and suburban areas, and to provide recommendations for prioritizing additional study of areas potentially contaminated by septic systems. Determining where groundwater quality is at risk from septic systems is essential information for regional water management and planning activities.

Sixteen Project Areas were identified for investigation. Data from these specific areas were analyzed to determine the potential for areas with high-density septic systems to contribute to contribute to water quality degradation. The final report identifies data gaps, prioritizes and makes recommendations for further study and analysis. Recommendations led to a follow up study: *Septic Nitrate Baseline Data and Risk Assessment Study, Phase II: In-depth Analysis of Prioritized Study Areas, Creation of Baseline Data Set and Risk Assessment* ("Phase II study").

The Phase II study prioritized nine areas (Mt. Rose, Ambrose, Hidden Valley, Huffaker, Verdi, Geiger, Island 18, Mogul, and Pleasant Valley) needing more in-depth analysis to fill data gaps identified in Phase I. Of 173 groundwater samples collected in 2014 and 2015 from domestic wells in the nine study areas, only two domestic wells, located in the Mt. Rose and Verdi areas, recorded nitrate levels above the MCL of 10 mg/L.

Samples were also collected from areas of known impact (Washoe Valley, Cold Springs and Heppner Subdivision in Lemmon Valley) that had not been sampled for 10 to 20 years to determine long term trends. 133 groundwater samples were collected from domestic wells in these three revisited study areas. Twenty-two of 83 samples from Washoe Valley were above the MCL and the highest was 50 mg/L. Of the 33 samples from Heppner, five were above the MCL with a high of 19 mg/L. In Cold Springs, none of the 17 samples were above the MCL.

In July 2016, the WCSD distributed approximately 5,000 informational letters to domestic well owners within, or in the vicinity of, each of the 12 study areas. The letters serve as a resource guide to educate homeowners on nitrate in groundwater and provide a summary of nitrate concentrations found within their study area.

Results of this study and previous studies point to the importance of septic system density, parcel size and distance to sensitive receptors.

Management options for mitigation of nitrate contamination due to high densities of septic systems have been studied regionally (AGRA, 2000), (Lombardo and AMEC, 2012), in Spanish Springs (WCDWR, 2002), Cold Springs (KJC, 2002) and Golden Valley (WCDWR, 2004). The results of these various analyses have coalesced around possible mitigation strategies:

- Conversion of septic systems to a municipal sewer system;
- Conversion of septic systems to nitrate reducing septic systems;
- Dilution of groundwater via artificial recharge with treated drinking water resources;
- Pumping of high nitrate groundwater for non-potable uses to remove nitrates from the groundwater aquifer; and
- Treatment of high nitrate groundwater for potable use.

TMWA will be conducting a pilot study of a novel biological nitrate and arsenic treatment process ("biottta™") in 2016 and 2017 on a municipal well in Spanish Springs. Specific goals of the pilot study are to:

- Confirm site-specific design and operating criteria for the removal of arsenic, including empty bed contact time and chemical feed requirements. These criteria will serve as the basis of design for regulatory compliance and a potential future full-scale facility.
- Demonstrate sustained nitrate and arsenic removal under steady-state operation.
- Demonstrate system stability under forced operating disturbances.
- Demonstrate the recovery time and performance of the system after a one-month system shutdown.
- Collect data to expand institutional knowledge on the effectiveness of arsenic removal through precipitation/co-precipitation, coagulation, and filtration through the biofilter.
- Familiarize operations staff with the system and develop operational protocol.

The pilot study will demonstrate the viability of biottta™ for nitrate and arsenic removal and will provide critical information for sizing and costing to better assess its technical and economic viability for scale-up to full-scale installation.

The WCHD has undertaken several measures to reduce future potential impacts from septic systems. For example, effective 2001, the minimum lot or parcel size for new subdivisions and second or subsequent parcel maps proposing to use septic system disposal was established at five acres. Smaller lots may be considered if it can be shown that adequate measures have been taken to ensure that the smaller lot area will not have a greater impact to the groundwater quality than the five-acre lot size.

Adequate measures might include the installation of nitrate reducing septic systems. These systems received considerable interest from the public in Spanish Springs Valley as a potential low cost alternative to conventional sewer service for dwellings currently using septic systems.

The Oregon Department of Environmental Quality (2005) conducted a multi-year project to study the performance of eleven individual nitrate reducing systems installed at residences near La Pine, Oregon. The study found that, although several systems showed high levels of nitrogen reduction in test centers, they did not perform as well in the field. Nitrogen reduction below 10 mg/L appears to be difficult to achieve consistently without a secondary carbon source.

Conversion of septic systems to a municipal sewer system appears to be the most reliable, albeit expensive, measure to mitigate nitrate contamination due to high densities of septic systems. Other solutions include artificial groundwater recharge using fresh water injected into the aquifer, such as is being done in Golden Valley, which has also proven beneficial in improving water quality with respect to nitrate.

The 2009 Nevada Legislature approved Assembly Bill 54 authorizing Washoe County to establish a financial assistance program to help property owners, among other things, connect to a public sewer system. The program is a direct response to property owner needs that are the result of changing economic conditions. When a property owner's on-site septic system fails and a

community sewer system is available, existing State and County regulations require that the property be connected to the municipal system.

The following policy, in conjunction with WCHD regulations and Washoe County development policies, responds to issues of groundwater contamination resulting from septic systems.

Policy 2.2.a: Septic Tank Density and Groundwater Pollution

Future development using septic systems should not be allowed in densities that would risk groundwater or surface water quality degradation such that applicable water quality standards are threatened. When adverse surface water or groundwater impacts occur as a result of existing or proposed increases to the concentration of septic systems in an area, alternative sewage disposal, groundwater treatment, or other mitigation measures must be implemented based on cost, longevity of the solution, and existence of a credible entity to be responsible for the continuing performance of the selected system.

4.4.1 Golden Valley

Both the East and West Lemmon Valley hydrographic basins, including Golden Valley, a sub-basin within East Lemmon Valley, are deficient in sustained perennial yields for water supply. All of Golden Valley's domestic wastewater treatment and disposal needs are provided by individual septic systems.

Groundwater samples from some areas of Golden Valley exceed state and federal drinking water standards for nitrate. Additionally, Widmer and McKay (1994) predicted that nitrate concentrations would increase over time. Washoe County and the U.S. Bureau of Reclamation ("BOR") implemented a federally funded artificial groundwater recharge pilot project by injecting fresh water into the Golden Valley aquifer from 1989 to 1998. Results of the study indicated that injection improved water quality with respect to nitrate.

Based on the groundwater recharge pilot project, a recharge program has been approved, funded and implemented by establishing a Golden Valley recharge service area. Presently, the program injects approximately 80 af of fresh water per year into the Golden Valley aquifer, and WCSD is investigating further options of expanding the injection system.

4.4.2 Spanish Springs

In 2000, the NDEP issued a directive to the County to plan for sewering existing lots with septic systems in the Spanish Springs area due to elevated nitrate concentrations detected in public drinking water wells. The subdivisions which are not sewered include Bridle Path, Sky Ranch, Surprise Valley Ranchos Phase I, Desert Springs and Pyramid Ranch Estates. Various design alternatives associated with plans for new facilities in Spanish Springs Valley that would provide service to the residents in Spanish Springs were evaluated by Washoe County. The two primary alternatives were the construction of a new treatment plant in Spanish Springs Valley or continued servicing via TMWRF. *The Spanish Springs Valley Wastewater Reclamation Facility Plan*, drafted in November 2004, indicated that the alternatives were essentially of equal cost. However, the connection fee for a new Spanish Springs plant would exceed the rate offered by Sparks for a connection to TMWRF. Thus, the recommended alternative was to continue service to TMWRF and negotiate an acceptable service agreement with Sparks.

The facility plan was adopted by the Board of County Commissioners for phased sewering of the existing lots with septic systems in the area. The plan requires 75 percent grant funding for the sewering to proceed. Phased sewering commenced in early 2005; Phase 1A of the program is complete and serves approximately 230 homes. Washoe County recently received grant funding from the Army Corps of Engineers ("ACOE") for the construction of Phase 1B.

The wastewater collection systems have been and will continue to be extended into new areas of growth.

4.4.3 Warm Springs

Projections indicate that septic systems will continue to service this area for the next 20 years. However, within the Specific Plan Area east of Pyramid Highway, a future wastewater treatment plant is anticipated to eventually serve a planned development of approximately 750 lots. The proposed 0.2 MGD treatment plant would be built in phases, with effluent disposal from the first phase accomplished using RIBs. For future phases, seasonal storage and irrigation using reclaimed water will likely be considered. The planned development is not being actively pursued at this time.

4.4.4 Washoe Valley

As described above, nitrate contamination to the groundwater system is occurring in the eastern portion of Washoe Valley. Effluent from septic systems is identified as the nitrate source (Zhan, H. and W.A. McKay, 1998).

4.5 Watershed Management Programs to Protect the Availability and Quality of Water Resources

The Truckee River, critical to the local economy and quality of life, is a shared resource in the Truckee Meadows and among upstream and downstream users. Effective watershed protection requires cooperation among two states, one sovereign Indian nation, multiple counties, cities, towns, various utilities, other entities and the public.

Watershed Management is an integrated approach to protecting water resources. The watershed approach coordinates environmental management within geographic boundaries to focus public and private stakeholders on the highest priority water quality problems. The objective of watershed protection is to develop management strategies that allow demands on water resources to be met while protecting beneficial uses throughout the watershed. The watershed approach brings together stakeholders most affected by management decisions, facilitates sharing of data and other technical resources, and encourages consensus building. Stakeholders may use an iterative process to identify and assess problems, prioritize, set environmental objectives, and develop management options and action plans. The watershed approach allows water resource specialists within the Truckee River watershed to develop creative solutions to issues that extend downstream and upstream across political jurisdictions, implement watershed management plans, and evaluate effectiveness.

4.5.1 Regulatory Considerations

Clean Water Act

In 1972, Congress passed the Federal Water Pollution Control Act, commonly referred to as the CWA. The CWA's objective was to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" and its main goals included: (1) "that the discharge of pollutants into the navigable waters be eliminated by 1985"; and (2) "that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983".

NPDES Permit Program

One of the first steps taken by the EPA to implement the CWA was the creation of the NPDES program, which controls water pollution by regulating point sources that discharge pollutants into waters of the U.S. The CWA defines "point source" as "any discernible, confined, and discrete conveyance including but is not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or vessel or other floating craft from which pollutants are or may be discharged" (CWA Section 502[14]). Industrial, municipal, and other facilities must obtain NPDES permits if their discharges go directly to surface waters.

Unlike pollution from industrial facilities and municipal sewage treatment plants, non-point source pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground picking up and carrying natural and human-made pollutants to lakes, rivers, other water bodies and groundwater.

Although the NPDES program succeeded in controlling many significant municipal and industrial point sources of pollution, studies conducted by the EPA and others in the 1980s identified storm water runoff from urbanized areas (i.e., non-point source pollution) as a leading cause of impairment to the nation's water bodies. Additionally, EPA reported in the early 1990s that nearly 40 percent of surveyed waters in the U.S. remained too polluted for fishing, swimming and other uses, and pollutants such as silt, fertilizer, metals, oil and grease were among the leading causes.

During this time, the EPA developed the *Watershed Protection Approach Framework* (published in 1991) as one strategy to address these issues. In addition, amendments to the CWA resulted in EPA requirements for NPDES permit coverage for storm water discharges from medium and large MS4 beginning in 1990. This addition to the NPDES program essentially shifted municipal storm water discharges from non-point source status to regulation as a point source. This is an example of the progressive nature of the NPDES program whereby over the years more sources have been included under the definition of point source pollution. The local NPDES storm water program is described in Section 4.5.5.

Water Quality Standards

The CWA also requires specific WQS to be set based on the intended use of the water, i.e., "beneficial uses". These include water quality for aquatic life propagation, recreational, agricultural, industrial, municipal and many other uses. Specific WQS are set by states, territories, and authorized tribes, which associate the beneficial uses for each water body with scientific criteria to support those uses. States can set standards that are less restrictive than EPA guidance values if the criteria are scientifically defensible and shown to protect the beneficial uses. WQS for Nevada are contained in NAC 445A.118-225.

Section 303(d) List of Impaired Waters

Section 303(d) of the CWA requires that each state develop a list of water bodies that need additional work beyond existing controls to achieve or maintain WQS, and submit an updated list to EPA every two years. The law requires that states establish priority rankings for waters on "303(d) lists" and develop TMDLs for these waters if they meet criteria.

The Nevada 2014 Water Quality Integrated Report ("Integrated Report") provides a comprehensive inventory of water bodies throughout the state, including a list of impaired waters now identified as Category 5 (previously labeled 303(d) waters). Impairments may be of all types and sources, and form the basis for targeting water bodies for watershed-based solutions. Nevada's most recent Integrated Report with its list of impaired waters was approved by the EPA in 2014 and can be obtained online at: http://ndep.nv.gov/bwqp/file/IR2012_Report_Final.pdf.

Total Maximum Daily Load

The additional work that may be necessary beyond existing controls for listed water bodies includes the establishment of one or more TMDLs. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive from all sources and still meet WQS. The TMDL process provides an analytical framework to identify the sources and causes of pollution, identify the relative contributions of each pollutant and establish allocations for each specific pollutant as needed to attain WQS. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the state has designated. The calculation must also account for seasonal variation in water quality. The point source portion of a TMDL is called a WLA and the non-point source portion, including background sources is called a load allocation ("LA").

4.5.2 Truckee River Total Maximum Daily Loads

Background on Truckee River Nutrient WQS and TMDLs

TMDLs have been established for the Truckee River within the State for three constituents, TN, TP, and TDS. TMDLs are measured at Lockwood under the assumption that if the TMDLs are being met at this location, downstream from TMWRF, they are being met on the rest of the "impaired" river reach.

The Truckee River downstream of the Truckee Meadows historically has been challenged with difficulty meeting aquatic life uses under existing WQS and TMDLs. In the 1980s, water quality sampling indicated that the Truckee River was impaired for low dissolved oxygen ("DO"). An overabundance of benthic algae was determined to be the primary cause of low DO. Benthic algae, also called periphyton, thrive in conditions with ample bioavailable nutrients (nitrogen and phosphorus) and shallow water depth (allowing for light penetration to the bottom) and increased opportunity for photosynthesis. Primary sources of nutrients to the Truckee River include natural background sources, nonpoint sources (e.g., stormwater, irrigation return flows, septic systems), and point source discharges. The largest point source in the watershed is the TMWRF that serves the cities of Reno and Sparks and portions of Washoe County. The TN and TP water quality criteria for the Truckee River were developed by the NDEP in the 1970s and have been refined over time, with the current standards set in 1984. In 1994, the NDEP established TMDLs for TN and TP in the Truckee River (NDEP, 1993). The 1994 Truckee River TMDL resulted in a TN allocation of 1000 lb/day, with half of the load (500 lb/day WLA) allocated to TMWRF and the bulk of the remainder, the LA, to nonpoint sources. The TMDL also specifies a TP allocation of 214 lb/day, with 134 lb/day allocated to TMWRF and the remainder, the LA, to nonpoint sources. The

TMDLs are summarized in Table 4-2. Each entity must comply with its NPDES permit requirements, including discharge limitations designed to meet the WLAs.

Table 4-2 Summary of Truckee River Total Maximum Daily Loads, Waste Load Allocations and Load Allocations

Source	Nitrogen	Phosphorus	TDS
Load Allocation			
Non-Point Sources/Background	450 lbs/day	75.25 lbs/day	None assigned
Waste Load Allocation			
TMWRF	500 lbs/day (annual average) 500 lbs/day (30-day average, May–Oct.)	134 lbs/day	120,168 lbs/day
Vista Canyon Group	16.7 lbs/day	4.75 lbs/day	9,730 lbs/day
Sparks Marina Lake	33.3 lbs/day	WLA Trade Agreement	19,390 lbs/day
Total Maximum Daily Load			
TMDL	1,000 lbs/day	214 lbs/day	900,528 lbs/day

Third Party TMDL Review

Reno, Sparks, Washoe County and the TMWA began leading a third-party effort to review the Truckee River TN and TP TMDLs starting in the mid-2000s. Several factors motivated the TMDL review. Although TMWRF is currently able to comply with the WLA designated by the 1994 TMDL, the ability of TMWRF to meet the TN WLA and serve future growth of the service area was thought in the early 2000s to require very costly advanced treatment technologies. In addition to regional growth, other driving factors to TMDL revision included improved river flow operations, advances in understanding the science of river processes, and a desire for more flexible solutions to water quality management. During the years since the 1994 TMDL was approved, new data were collected, new modeling tools were developed, and operation of the Truckee River dams and diversions had changed. The additional data and enhanced modeling tools have improved the understanding of how the river assimilates (i.e., takes up or absorbs) nutrients, and how improved river flows may result in a higher assimilative capacity for nutrients.

The NDEP and EPA agreed that a third-party review of the 1994 TMDL is appropriate to determine whether the assumptions underlying the 1994 TMDL remained valid, and to identify new scientific and technical information and/or changes in conditions and river operations that may warrant a different approach to addressing nutrient issues in the watershed. The NDEP has the authority to adopt, modify or reject a third-party TMDL based on a variety of factors. EPA approval of TMDLs is required.

A Truckee River WQS/TMDL Working Group ("Working Group") was formed and included representatives from Reno (third-party), Sparks (third-party), Washoe County (third-party), TMWA (third-party), WRWC, the NDEP, EPA Region 9, LimnoTech (consultant) and Stantec (consultant). In 2011, the third-parties, the NDEP and EPA jointly developed and finalized a TMDL/WQS Review Work Plan to describe a process for the review including roles, responsibilities and expectations. In consultation with the NDEP and EPA, the third-parties agreed to facilitate public outreach and obtain input from affected stakeholders at key decision points in the review and revision process. The TMDL review was put on hold after the Working Group deemed a WQS review was necessary to ensure that appropriate standards were used in any TMDL revisions.

4.5.3 Truckee River Water Quality Modeling

The third-parties, with funding from the WRWC, retained the services of the consulting firm LimnoTech to conduct the majority of the technical work related to the TMDL review. The foundation of the technical work is the development and application of a set of watershed and river water quality models that provide linkage between nutrient levels in the Truckee River and resulting DO levels:

- Watershed Analysis Risk Management Framework ("WARMF") – watershed model; and
- Hydrological Simulation Program FORTRAN – river water quality model.

The combination of extensive data and improved computer tools had greatly increased the general understanding of the Truckee River and related watershed processes as well as improved the ability to better simulate the river and watershed under contemporary conditions. The two linked models were run together to provide an understanding of how the Truckee River system assimilates nutrients and complies with DO criteria under a representative flow condition. The models simulated the complex relationship of how nitrogen and phosphorus, in combination with other factors such as temperature and light, can lead to excessive growth of algae and ultimately a situation of depleted DO. The following sections provide a brief summary of both models.

Truckee River Hydrological Simulation Program FORTRAN ("TRHSPF") is an in-stream water quality model used to predict occurrences of low DO resulting from benthic algae, low flow, and other pollutants. It incorporates peer-reviewed empirical and theoretical equations related to the growth, death, nutrient preferences and removal of benthic algae based on the DSSAMt model, which is a variation of the DSAMM III model used for the 1994 Truckee River nutrient TMDL. TRHSPF inputs include projected point source flows and diversions as generated by a water operations model, and tributary flows and non-point source loads from a watershed model.

The Truckee River Operations Model ("TROM") is a water operations model that projects regulatory flows (reservoir releases, diversions) with and without different flow management strategies (e.g., *TROA*) in place. The model accounts for future municipal and industrial ("M&I") demands, and conversion of water rights from agricultural use to M&I. TROM was used to support the *TROA* Environmental Impact Statement/Environmental Impact Review analysis released in 2008. TROM output, available for a 100-year period, is used for input to the watershed and water quality models to define conditions with and without flow management in place.

The WARMF is a watershed model adapted to the Truckee River basin that predicts non-point source loads under current and future land use as well as projects potential non-point load reductions. WARMF inputs include meteorology, land use, as well as managed flows provided by TROM (e.g., reservoir releases, municipal and agricultural diversions). WARMF calculates the distinction between storm water and non-storm water non-point sources and also simulates potential improvements and reductions of non-point source loads from best management practices ("BMPs"), conversion of agricultural lands, and removal of septic systems.

Tributary flows and non-point source loads predicted by WARMF are linked to the in-stream water quality model, TRHSPF. TRHSPF calculates in-stream temperature and constituent concentrations (e.g., nutrients, DO), and has the capability to assess potential nutrient assimilative capacity benefits due to deeper water and cooler temperatures realized through stream restoration. The two linked models, run together under various flow management scenarios, provide an understanding of how the Truckee River system assimilates nutrients and complies with WQS. These modeling runs and improved descriptions of riverine conditions are

provided on the Truckee River Info Gateway (documents for the runs may be found at www.truckeeriverinfo.org/tmdl) including The Final Truckee River Water Quality Standards Rationale report by LimnoTech (2014).

Nevada Nutrient WQS Review

During the course of the nutrient TMDL review and revision, two important efforts were conducted to review and revise nutrient WQS for the Truckee River. The third-parties supported the NDEP's triennial review and the PLPT conducted an independent triennial review of nutrient WQS.

The NDEP and EPA agreed to consider any third-party proposed revisions to the existing nutrient WQS in an effort to assure that the WQS are appropriate and that any TMDL revision would be based on the best available WQS. The existing nutrient water quality criteria were based on limited information such as algal growth studies conducted in the late 1970's (before TMWRF upgrades) and EPA's "Red Book" (EPA, 1976). The NDEP had recognized that these criteria were in need of improvement.

In 2011, the NDEP issued notice of its intent to conduct a triennial review of WQS and requested comments to consider for potential revisions. Reno, Sparks, and Washoe County each requested a review and potential revision of the TP and TN WQS for the Truckee River. The third-party led effort that followed, sponsored in part by WRWC, provided scientific support in the reassessment of WQS.

An important element of the WQS review process was engagement with watershed stakeholders in order to fully vet the interests, concerns, and potential impacts of any changes to WQS or TMDLs. Key watershed stakeholders were engaged on an individual basis, followed by the formation of a Truckee River WQS Focus Group ("Focus Group") and a series of workshops. In addition to members of the Working Group, the Focus Group included representatives from Churchill County, City of Fernley, Pyramid Lake Paiute Tribe, Truckee Carson Irrigation District, U.S. Fish and Wildlife Service ("USFWS"), and Nevada Department of Wildlife ("NDOW"). All Focus Group members were encouraged to provide comments throughout the process via both written feedback forms and opportunities for verbal comments during the workshops.

Technical Approach and Results

The foundation of the technical work involved application of the linked and calibrated WARMF-TRHSPF models to evaluate potential nitrogen and phosphorus water quality criteria. A full description of the technical activities was documented by LimnoTech, (2014) and a summary of results is provided below.

Several observations were summarized from the water quality modeling effort which examined a range of nutrient concentrations over both low (10^{th} percentile) and average (50^{th} percentile) flow regimes.

In the Nevada region of the Truckee River (East McCarran Blvd. to PLPT Boundary), the level of DO criterion violation is low over the entire range of annual average nutrient concentrations examined. Additional observations include:

- For both low and average flow regimes, the DO criterion compliance does not show a sensitivity to increasing phosphorus concentrations; and

- For the low flow regime, the DO criterion compliance shows a slight sensitivity to increasing TN concentrations; however, this response does not occur unless the annual average TN concentration is greater than approximately 0.80 mg/L.

In the PLPT region of the Truckee River, the level of DO criterion violation varies depending on the annual average nutrient concentration and the flow regime[1]. Additional observations include:

- For the low flow regime, the level of DO criterion violation in the Truckee River is sensitive to the annual average phosphorus concentration; however, no DO criterion violations were calculated for the average flow regime;

- For both the low flow and average flow regimes, DO criterion violation in the Truckee River does not show sensitivity to the average annual TN concentration over the range examined; however, for the low flow regime the DO criterion violations ranged from approximately three percent of days to six percent of days depending on the phosphorus concentration; and

- For the average flow regime, no DO criterion violations were calculated for the Truckee River regardless of the annual average nutrient concentrations.

- DO criterion violations in the Truckee River are seen to be sensitive to other factors beyond the instream phosphorus concentration such as flow condition, channel geometry and stream temperature.

The purpose of the process and analysis was to provide the NDEP and EPA with technical information to support the triennial review of the nutrient WQS for the Truckee River in Nevada. Any proposed recommendations for changes from the existing nitrogen and phosphorus numeric nutrient criteria would have needed to be documented by the NDEP in a rationale document which would be available for public comment. Any proposed changes would need to be approved by the State Environmental Commission and EPA before becoming effective under the federal CWA.

Two alternate scenarios for Nevada nutrient standards were given detailed examination: (1) Maintenance of existing standards; and (2) Switching the phosphorus standard from the existing TP=0.05 mg/L to the PLPT standard of OP=0.05 mg/L. Results showed that if the Nevada phosphorus criterion were changed to be consistent with the (then) current PLPT criterion, there would be no expected increase in DO violations in the Truckee River from East McCarran to the PLPT boundary under either low flow or average flow conditions compared to conditions under existing standards.

The full technical analysis was documented (LimnoTech, 2014) and presented to the NDEP, key stakeholders and the interested general public during a public meeting March 3, 2014. Additional reports and presentations regarding the WQS review process are available from the Truckee River Information Gateway ("TRIG") website (http://truckeeriverinfo.org/tmdl).

After completion of the technical analysis, no immediate action was taken by the NDEP to complete the WQS review. The NDEP met with PLPT in April 2014 and Tribal representatives indicated their intention to initiate their own triennial review of WQS for the Truckee River. A decision was made to suspend the NDEP WQS review until PLPT completed their review[2].

[1] See Appendix G, NDEP comments.
[2] See Appendix G, NDEP comments.

4.5.4 PLPT Water Quality Control Plan, Triennial Review and Water Quality Standards Revisions

PLPT Water Quality Control Plan

In January 2007, EPA granted the PLPT "treatment as a state" status for adoption of WQS and conducting CWA Section 401 water quality certifications within the boundaries of the Pyramid Lake Paiute Indian Reservation. In September 2008, the PLPT adopted a *Water Quality Control Plan* ("WQCP"), which addresses issues such as beneficial uses, antidegradation, water quality criteria, scientific justification, and implementation plans. The EPA approved the WQCP on December 19, 2008. The WQCP includes narrative and numeric WQS for Pyramid Lake, the lower Truckee River and all surface waters within the Reservation.

The WQCP includes numeric water quality criteria for both nitrogen and phosphorus. The TN standards in the WQCP are identical to the Nevada criteria applicable to the Truckee River from McCarran Boulevard to Wadsworth. However, with regard to phosphorus, the WQCP criterion is expressed as orthophosphate, in contrast to the State's 1984 criterion for TP, which is a more stringent standard. The WQCP criterion is designed to protect the most sensitive beneficial uses of the downstream reaches of the river. According to the WQCP, the orthophosphate criterion is "based on its secondary importance in regulating algal growth" (PLPT, 2008). The WQCP notes the advantage of this criterion over TP is that "it regulates the availability of phosphorus to the algae" and avoids triggering exceedances of the WQS due solely to increased turbidity, which is separately regulated.

Triennial Review and Water Quality Standards Revisions

On April 27 and April 30, 2015, the PLPT conducted public workshops to present the Triennial Review process and methodologies for review of their WQCP (i.e., WQS). On June 3, 2015, the PLPT presented results of their Triennial Review of WQS and rationale for proposed changes to certain standards. The PLPT provided a public comment period from May 26, 2015 to August 21, 2015.

The PLPT proposed a significant change to the DRP criterion for the Truckee River, reducing it from 0.05 mg/L to 0.022 mg/L. The proposed standard was set to provide consistency with the existing NDEP TP criterion (set in the 1980's), but no justification was provided on the appropriateness of the current NDEP TP criterion[3]. The PLPT finalized their Triennial Review and WQCP on September 15, 2015. The proposed reduction of the DRP criterion for the Truckee River (annual average ≤ 0.022 mg/L P) was approved by EPA on December 23, 2015 and implemented by the PLPT (PLPT, 2015).

Potential Implications of WQS Outcomes

With the revised PLPT DRP criterion approved, it is highly unlikely that the NDEP TP criterion would be revised to a value higher than 0.05 mg/L. This is due to the fact that WQS from upstream jurisdictions must maintain compliance with WQS for downstream jurisdictions. To date, the third parties have taken no further action concerning the review of the NDEP TMDLs.

[3] See Appendix G, NDEP comments.

4.5.5 Truckee Meadows Regional Storm Water Quality Management Program

In the 1980s, studies conducted by the EPA and others indicated that storm water runoff from urbanized areas is a leading cause of impairment to the nation's receiving water bodies. These studies and numerous legal actions by environmental organizations culminated with the publication of federal regulations that required municipalities to control non-point source pollution in urban runoff that flows through their storm drain systems. The regulatory process began in 1987 when Congress amended the CWA. In 1990, under Phase I, the EPA required NPDES permit coverage for storm water discharges from medium and large MS4s located in urban areas with populations of 100,000 or more. On March 10, 2003, Phase II of the NPDES storm water program became effective. In addition to requiring permit coverage for certain regulated small MS4s, Phase II also lowered the threshold for regulation of construction activities from five acres to one acre of land disturbance.

The following policy supports the Truckee Meadows Storm Water Quality Management Program ("TMSWMP"):

Policy 3.1.f: Adoption of Uniform Storm Water Quality Programs

A storm water quality program shall be implemented region-wide, including the continuation and/or enhancement of existing programs in Reno/Sparks/Washoe County, such as the Truckee Meadows Regional Storm Water Quality Management Program, to address not only urban runoff but also other non-point source contributions.

Storm Water NPDES Permits Pertinent to the Truckee Meadows and Nevada

Per federal regulations (40 Code of Federal Regulations § 122.26), the NDEP has issued the following three baseline general permits that regulate storm water discharges in the Truckee Meadows:

- The Municipal Storm Water Discharge Permit (NVS000001) was issued to Reno, Sparks and Washoe County effective May 26, 2010 to May 25, 2015, renewed permit has been requested and is expected in 2016;
- The General Permit for Storm Water Discharges Associated with Construction Activity (NVR100000), effective January 5, 2015 to January 2020; and
- The General Discharge Permit for Industrial Activity (NVR050000), effective September 22, 2008 to September 21, 2013.

The full text of each of these permits can be viewed at http://ndep.nv.gov/bwpc/storm01.htm. The requirements of these permits apply to all urban development, whether public or private. Each permit indicates that a minimum set of BMPs shall be implemented and pollutants in storm water discharges shall be controlled to the maximum extent practicable. Maximum extent practicable is a regulatory standard developed by the EPA that has been interpreted to give local governments some flexibility in developing storm water management programs that are adapted to their local conditions.

Truckee Meadows Municipal Storm Water Discharge Permit

The Municipal Storm Water Discharge Permit authorizes storm water discharges into receiving waters of the U.S. within Reno, Sparks and Washoe County. The permitted area includes the

limits of the urbanized area within the TMSA as established by the Truckee Meadows Regional Plan. This area includes areas which are, or could reasonably be, urbanized within the time covered by the permit.

Program Schedule and Annual Reporting Requirements

The most recent five-year permit was issued to the Truckee Meadows on May 26, 2010. Reno, Sparks and Washoe County were required to update the *Storm Water Management Program* ("SWMP"), the document describing permit compliance for all components of the program for the permit term. Stantec Consultants was hired to provide an updated SWMP in December 2011, providing an analysis of the program element needs, activities and schedule for the permit term. This document will remain in place until a new permit is issued and will describe the timeline for annual report submittals in January each year to report on the previous fiscal year. When a new permit is issued, the SWMP will require an update to meet regulatory requirements described in the new permit.

Background

The NDEP issued the first NPDES Municipal Storm Water Discharge Permit jointly to Reno, Sparks, Washoe County and the Nevada Department of Transportation ("NDOT") in 1990. The four entities entered into an interlocal agreement and formed the Truckee Meadows SWPCC. The purpose of the committee was to define responsibilities and funding options for implementing the required components of the permit, and to submit annual reports to the NDEP and the EPA.

Early on, the SWPCC conducted monitoring of various land uses, drafted a construction site best management handbook in 1994, and considered impacts of various street sweeping technologies. The NPDES storm water permit has a five-year term. However, the NDEP did not issue the second permit until the year 2000. The 2000 permit more explicitly directed the four permitted entities to develop, administer, implement and enforce a SWMP that addressed:

- Intergovernmental Coordination;
- Construction;
- Industrial;
- Illicit Discharge and Detection;
- Monitoring;
- Land Use Planning;
- Structural Controls;
- Municipal Operations; and
- Public Outreach.

Each of the elements will be discussed further as to what has been accomplished, future compliance issues and needs, and the role of the Regional Water Management Fund ("RWMF") will be summarized.

The goal of the program is to implement BMPs and reduce the pollution in urban runoff prior to it entering the permittees' storm drain systems and discharging to receiving waters such as the Truckee River and its tributaries. Urban runoff includes dry weather flows from activities such as watering and outdoor washing, illegal connections and discharges to the storm drain system, as well as runoff from storm events.

In August 2000, the SWPCC began the process of developing a SWMP with the required elements specific to the Truckee Meadows. A series of public meetings and workshops were conducted throughout 2000 and 2001 to define local water quality goals, resources, stakeholders and interested parties.

The finalized TMSWMP presented a comprehensive approach to implementing each program element and contained priorities, approaches, guidance and schedules for programs, activities and effectiveness evaluation. The schedule for program implementation extended past the permit term.

In January of 2002, EPA conducted an audit of the Truckee Meadows. As a Phase 1 community, EPA expressed that the Truckee Meadows should have had many of the required elements well underway. The repercussions of the audit impacted both the State and the Truckee Meadows programs. The NDEP added staff and became more proactive in the implementation of the storm water NPDES program throughout the State. For the Truckee Meadows, the most significant outcome was the requirement that the program elements for construction and industrial storm water inspections be accelerated and in place by July 2003. This was the effective date of CWA Storm Water Quality Phase 2 which lowered the threshold of construction sites requiring a Storm Water Pollution Prevention Plan ("SWPPP") from five acres to one acre.

Intergovernmental Coordination

The SWPCC has continued to implement and update the SWMP. In 2004, NDOT withdrew as a permittee to be permitted independently. This prompted the need to amend the Interlocal Agreement originally approved in 1990. While considering amending the agreement to address the withdrawal of NDOT, other changes were incorporated. The SWPCC concluded that their efforts would be better served by two representatives from each permitted entity, now Reno, Sparks and Washoe County (the "co-permittees"). Reno continues as the lead agency and provides the program coordinator, legal and secretarial support.

In 2003, the Regional Water Planning Commission ("RWPC") funded and accepted a *Watershed Management Plan* for the Truckee Meadows. It was suggested that an oversight committee be developed for the implementation of this plan. The SWPCC recognized that the SWMP is a substantial aspect of watershed management and, since the SWPCC has equal representation of the responsible governmental entities in the Truckee Meadows, it was also concluded that expansion of the purview of the committee to include watershed management for water quality was appropriate.

The amended Interlocal Agreement, approved by Reno, Sparks and Washoe County in March 2004, explicitly states that the SWPCC is to advise the City Councils of Reno and Sparks, and the Washoe County Commission with respect to any and all matters relating to storm water permit compliance and policies (relative to matters relating to watershed management and protection), which encompasses only the water quality impact to the watershed. The SWPCC will continue to review, modify and update the *Watershed Management and Protection Plan* dated May 9, 2003. (See Section 4.5.10)

Construction Site Discharge Program

The Construction Site Discharge Program integrated storm water quality management and the requirements of the NPDES General Construction Permit into existing local construction permitting and inspection programs. Erosion, sediment transport and pollutant discharges from construction sites are of significant concern to the NDEP and EPA. The Construction Site

Discharge Program element was in place and effective by June of 2003 to meet an EPA directive. The NDEP re-issued a five-year General Discharge Permit for Storm Water Discharges Associated with Construction Activity (NVR100000) effective January 5, 2015.

Two primary resources have been developed to assist the construction community:

- Truckee Meadows Construction Site BMP Handbook; and
- Nevada Construction Site BMP Field Guide.

The *Truckee Meadows Construction Site BMP Handbook* was finalized in March 2003, and updated in 2007 and 2015. Policies and procedures were updated to provide regional consistency as well as consistency with the State general permit. The documents developed along with the Handbook include a Construction Permit Submittal Checklist, a Performance Standards Compliance Checklist, a Construction Site Inspection Checklist and a model.

The development of the Handbook was made a priority and a template was created for SWPPP. Concurrently, the co-permittees internally developed inspection programs according to their individual plan review and inspector resources.

Once the Handbook was completed and accepted by the RWPC, community outreach and education was conducted through the American Society of Civil Engineers ("ASCE"), the Builders Association of Northern Nevada ("BANN"), Associated General Contractors ("AGC") and others. The permittees offer on-going basic training in the proper use of BMPs at construction sites typically in the spring and fall through BANN and AGC.

Subsequently, a pocket-sized, waterproof field guide was developed to assist the construction industry in better understanding installation and maintenance of construction BMPs for storm water quality management. To leverage funding opportunities, this guide was developed with the intent that it could be used throughout the State. The Field Guide was developed by Kennedy Jenks Consultants ("KJC") and managed by the SWPCC. Funding was provided by Reno, Sparks, Washoe County, the NDEP, and the RWMF. The field guide was updated in 2013, with funding provided by the WRWC, and is available at Construction Site BMP Trainings for all attendees, as well as through the Nevada Circuit Rider program. The Truckee Meadows Construction Site BMP Handbook was updated by Farr West Engineers in 2015 and accepted by the SWPCC. All guidance documents including the *2015 Truckee Meadows Construction Site BMP Handbook update* and the 2013 Nevada BMP Field Guide are available for download at www.TMstormwater.com.

Industrial Discharge

Concurrent with the development of the Construction Site Discharge Program, the entities considered how the industrial inspection program would be implemented. The State of Nevada would be primarily responsible for determining what businesses needed permits and for issuing permits. The permittees are responsible for implementing a program to keep polluted runoff from entering their respective MS4s. Reno and Sparks already had an active staff of inspectors for wastewater pretreatment inspection for businesses throughout the Truckee Meadows. Moreover, there was already an agreement between the Cities and Washoe County to conduct pretreatment inspections within the unincorporated areas. It was concluded that using the existing pretreatment programs would be the most effective means of implementing the Industrial Discharge element.

The co-permittees funded development of the Industrial Program Video for outreach to commercial operations and provided it to each business in Reno, Sparks and Washoe County visited by the inspectors over a one-year period. An Industrial BMP manual was also developed and is available for download at www.TMstormwater.com, or in hard copy at Reno and Sparks offices.

Illicit Discharge Detection and Elimination

Illicit discharges are typically identified through public reporting, inspections, outfall sampling, or by maintenance crews during day-to-day cleaning of the storm sewer systems.

The co-permittee's maintenance divisions have been advised that in the event they find discoloration, odors, or other evidence of pollution, they are to contact Environmental Control staff. Subsequent investigations may lead to identification of illicit discharges that can be remedied. Annual staff trainings occur on a rotating basis between the co-permittees to support the Illicit Discharge Detection and Elimination program.

Reno and Sparks Environmental Control staffs conduct inspections of the major outfalls along the Truckee River annually. The inspection is intended to occur during a period when there should not be any flow of storm water. If there is flow from the outfalls, they are sampled and analyzed for evidence of basic pollutants. Through this exercise, there have been illicit discharges identified and corrected. In some cases, however, the source cannot be identified.

Public Education and Outreach

The website at www.TMstormwater.com provides information for all audiences: citizens; industry and developers; and regulators or other parties interested in the SWPCC. Each of these portals provides contents for the respective audience, including contact information for committee members; program elements; posted guidance documents; upcoming trainings; online mapping; data and permit tools; program news and meetings; frequently asked questions; hotlines for reporting spills and water quality related issues; information about storm water pollution and the storm drain system; related community programs; federal and state requirements; BMPs; commonly used terms; and other sources of information. Downloads of all guidance and technical documents are available on the website.

Numerous approaches to Public Education and Outreach have been conducted. Staffs have provided many presentations about the program to the professional community and to the public. Collaborative efforts such as with the University of Nevada Cooperative Extension ("UNCE") have implemented programs utilizing television and Non-point Education for Municipal Officials ("NEMO"). Other efforts have included public participation to clean up areas within the watershed and storm drain stenciling. Outreach is an ongoing effort. Current activities are further described in Section 4.5.13.

Storm Water Discharge Monitoring

The objective of the Storm Water Discharge Monitoring program is to quantify the benefits of program implementation. The SWPCC updated the Sampling and Analysis Plan, describing monitoring activities most recently in 2015 (Balance Hydrologics) that has been accepted by the NDEP and took effect on October 1, 2015. The SWPCC also requested a shift from monitoring on a calendar year basis to a water year basis, which took place in 2015. The water year is defined as October 1 through September 30, and monitoring data collected during this time will be reported in the Annual Report due January 15 each year. The focus was on monitoring tributaries

upstream and downstream of urbanized areas to observe water quality and quantity changes with mixed land usages and significant areas of new development until 2015. With constraints on budgets, and a desire by the SWPCC to seek further analysis of impairments, the program surrendered some upstream monitoring locations that provide a consistently unimpaired dataset, in order to expand on downstream locations. A nested approach has been introduced to get more clarity on issues impacting the urban watershed of the Truckee River.

Currently, ambient conditions are measured twice annually in three locations of Steamboat Creek, two locations in North Truckee Drain ("NTD"), one downstream location in each Thomas Creek and Whites Creek, Alum Creek, and Chalk Creek. As well, the SWPCC has expanded the storm event monitoring program to include the above named sites, as well as a series of urban outfalls to the Truckee River. Equipment usage has expanded to incorporate autosamplers to capture hydrologic limb-based water quality for a series of one to two storms per site, and contractors have been brought in to capture the less predictable storm discharges in the rain shadow of the Sierra, here in the Truckee Meadows.

Constituents to be analyzed are focused on those for which TMDLs on the Truckee River have been established: (P, N, and TDS). The storm water monitoring data is being posted on the TRIG website (www.truckeeriverinfo.org). The 2010 Storm Water NPDES permit placed a greater emphasis upon quantifying the contribution of pollutants to the Truckee River and its tributaries. Based upon conversations with the NDEP and observations of national regulatory trends, it is anticipated that there may be a WLA assigned to storm water in the future. Locally, storm water contributions to the TMDL have been regarded as background and included in the LA. It is not yet known how, when or for what constituents a storm water WLA will be implemented, but the SWPCC remains in close communication with the NDEP.

Under the Storm Water Discharge Monitoring program, the SWPCC monitored four tributaries quarterly for the permit period 2005-2010. The 2015 Sampling and Analysis Plan (Balance Hydrologics) associated with this permit outlines monitoring sites, field procedures and laboratory analyses. The SWPCC has been accounting for TMDL constituents, as well as water quality impairments as defined by the 2012 Integrated Report, in building an understanding of storm water quality and impacts on any impairments. Through this evolution, the SWPCC, staff, and consultants gather water quality measurements and grab samples for TN, TP and TDS, accounting for flows and generated loading values. Data generated by this program may be found in the Truckee River Info Gateway website, data section at www.truckeeriverinfo.org.

Historically, sampling locations on tributaries were chosen to compare upstream and downstream water quality on tributaries around urbanized areas. The SWPCC has expanded the approach and refined questions asked of the monitoring data, intending to evaluate urban outfalls to the Truckee and an understanding of the effects of storm patterns on the watershed, as they pertain to timing, peak flows, and water quality.

Chalk Creek was not included on the original storm water permit, but was added later when high levels of TDS, N and P were identified. This historically ephemeral subwatershed underwent heavy urbanization between 1986 and 2006, and now has perennial flow. The Hunter Creek sandstone layer underlying most of the area has been shown to be problematic for water quality with efficient transport of N and P applied to outdoor areas (*Chalk Creek Watershed Characterization*, JBR Environmental Consultants, 2010). The same geologic formation, once transformed with development and irrigated regularly, also leaches minerals from soils, mostly present as sulfates, which seep out through the creek's banks as highly 'salty,' algae-rich waters. The upper reaches of Chalk Creek remain ephemeral in areas of development in the upper

watershed, and the creek becomes perennial in the urbanized area. For this reason, there has been no sampling point reflecting upstream, non-urban conditions on this creek.

Consistent with the findings from waters in urban areas around the country by the EPA, local creek data shows declining water quality as creeks pass through developed areas. The SWPCC is in the process of initiating a trend analysis for storm water data and evaluating performance of BMPs in the watershed relative to water quality.

Subwatersheds in the Truckee Meadows region are characterized by historical land uses, which include timber collection, mining, and heavy geothermal activity. This lends complexity to sample results due to influences from mineralization, mining, geothermal activity and geologic formations. In a June 16, 2013 Tech Memo prepared by Stantec, there was an analysis provided of background conditions provided by ambient water quality results, which addressed current impairments and whether storm water contributed to the impairments.

Municipal Operations Program

The Municipal Operations Program is improving over time. Maintenance activities such as street sweeping, catch basin cleaning, ditch cleaning, and waterway maintenance were primarily focused upon flood conveyance and capacity. Now, there is much more of an awareness to conduct these activities in a way that considers water quality as well.

Street sweeper equipment in all three jurisdictions have been upgraded to vacuum and regenerative air sweeper truck models, which reduces the amount of pollutants reaching the storm drain system and helps the municipalities meet air quality particulate matter ("PM10") requirements set by the EPA. New air quality regulations were enacted in the Truckee Meadows in 2003 with the intent to reduce PM10. The regulations required that all publicly owned street sweepers purchased after January 1, 2002 must be certified under clean air standards. Public entities must reduce the amount of road sand applied during winter storms and sweep up after a sanding event within four days or as soon as weather permits.

Since Reno and NDOT corporation yards are located near the Truckee River, they were the first to be addressed during the 2002 EPA audit. Of greatest concern was sand/salt storage. Each entity has since implemented improvements to cover sand and salt stockpiles as well as apply BMPs to their facilities and make operational modifications to protect the quality of storm water runoff leaving their sites.

In the 2013 audit of the SWMP performed by the NDEP and EPA, the corporation yards were evaluated at each of the three co-permittees yards. One of the requests made of the staff was the development of a site inspection form and checklist, to be performed regularly by each agency. Entities incorporated this regular inspection during Fiscal Year 2014-15 and reported results in annual reporting.

Structural Controls

Structural Controls and Low Impact Development ("LID") are approaches intended to provide post construction storm water quality management. Structural treatment controls can be considered public domain treatment controls or manufactured (proprietary) treatment controls. Public domain treatment controls are those that can be designed by an engineer and have been implemented and tested by numerous communities throughout the nation. Manufactured (proprietary) treatment controls are patented devices that have been engineered and constructed by private companies. LID is considered a public domain treatment control. It is a methodology for

accommodating storm water runoff within new development and redevelopment that mimics natural hydrologic functions within a site. Rather than conventional hard-piping from impervious surfaces, LID uses features such as vegetated swales, bioretention systems and permeable pavements.

These types of features:

- Utilize natural biological, physical and chemical treatment processes for treatment;
- Promote percolation and water table recharge;
- Slow runoff flows and reduce runoff volumes; and
- Reduce pollutant loads gathered from impervious surfaces sheet flow.

The result is:

- Improved water quality to the receiving water;
- Decreased runoff volumes and flows; and
- Improved water table recharge.

In January 2004, the *Structural Controls Handbook* was finalized. Structural Controls program implementation is not clearly defined by the EPA or the NDEP and is left up to the community. Public meetings and handbook development processes have prompted numerous questions: what is a practical threshold to impose structural controls for new development and redevelopment, what should be involved in the permitting, application and design approval process and how should the structural controls be tracked, inspected and maintained? To answer these questions fairly, it was the consensus of the SWPCC that the use of a professional advisory group ("PAG") was warranted. The PAG was comprised of local engineers, planners, developers and contractors. Several facilitated meetings of the PAG took place over the course of a year.

By May 2005, the SWPCC accepted the *Final Recommended Policies and Procedures for Structural Controls and LID in the Truckee Meadows* (prepared by KJC). One of the PAG recommendations was the development of standard design worksheets to aid in simplifying implementation of the Storm Water Quality Management practices and LID. KJC was retained for this purpose with the cost shared by Reno, Sparks, Washoe County and the RWMF.

The purpose of the Standard Guidance Worksheets is to aid in simplifying implementation of the Storm Water Quality Management practices and LID standards. The standard design templates assist community development staffs during plan review by providing readily accepted storm water design templates. Worksheets were updated in 2012 to include Self Treating Areas. The design templates are posted on TMstorm water.com so that they can be easily accessed.

In September 2007, staff from Reno, Sparks and Washoe County provided all-day training on the implementation of Structural Controls for Post Construction in a workshop sponsored by ASCE and the American Public Works Association.

In addition, Reno has adopted an ordinance requiring the use of structural controls for post construction storm water management for new development and redevelopment. This ordinance was updated in 2016 with the updates of the Structural Controls and LID Manuals, as they were codified. Updates to the manuals included a reformatting and integration into one manual, the Truckee Meadows Structural Controls Design and LID Manual.

Land Use Planning

Post-construction storm water management is required for New Development and Significant Redevelopment. The tools that have been created through the SWPCC and watershed facilitation have prepared the Truckee Meadows to implement a program. The *Low Impact Development Manual* provides planning assistance while the *Guidance on Source and Treatment Controls for Storm Water Quality Management* assists the designer to incorporate Post Construction Storm Water management into their projects. Engineering analysis must show that the proposed storm water quality management measures are capable of capturing runoff and potential pollutants from the site in compliance with the specifications of the *Truckee Meadows Structural Controls Design and Low Impact Development Manual*. The analysis must illustrate the drainage subareas and demonstrate the proposed mitigation measures are designed to meet or exceed the minimum treatment standard required. The Design Guidance Worksheets have been created to provide a consistent submittal format and when properly completed, demonstrate sufficient engineering. The worksheets are provided in Appendix F of the manual and are also available online at tmstormwater.com.

Storm Water Program Needs

The SWMP for the Truckee Meadows will be updated with new priorities and timelines developed for the current permit term, once the new permit is issued.

The state of the economy has affected local monitoring efforts. The monitoring locations on the tributaries were selected to leverage monitoring sites already being maintained by the U.S. Geological Survey. Because of funding constraints, monitoring sites along the Truckee River and on the tributaries are being called into question. Consequently, it is becoming apparent that greater funding resources will need to be allocated to the monitoring element. A new monitoring plan was developed to assist the SWPCC to quantify the program effects. This document was named the Truckee Meadows Sampling and Analysis Plan. The intent is also to further benefit from the regional model; WARMF, a watershed model adapted to the Truckee River basin, to forecast non-point source loads under current and future land uses and project potential non-point source load reductions.

Use of structural controls and applying LID principles to new development and redevelopment is still a new approach. The development community needs continued education and training in the design, construction and maintenance of structural controls and LID features. With updates to the guidance documents associated with structural controls and LID will come trainings for staff and consulting community alike.

The tributary watershed assessments were conducted from 2003 to 2012, at which time the SWPCC determined it was time to implement projects identified in the reports. Monitoring the effects of development upon the area's streams has increased awareness of the need for stabilization. There are numerous issues to consider in the maintenance of waterways, stabilization techniques, invasive weed eradication, restoration efforts and buffer zone implementation. A common understanding or MOU and funding source should be established for the Truckee Meadows tributaries and ditches that convey flow to the Truckee River. Implementing educational programs for inspectors and plan checkers for BMPs on and around these waterways is needed.

4.5.6 Truckee River Coordinated Monitoring Program

Background: The Truckee River watershed is currently monitored and sampled by many different groups for water quality. Under the CWA, the Truckee Meadows Municipal Storm Water Permit permittees monitor six Truckee River tributaries on a regular basis, per the MS4 permit requirements and Sample Analysis Plan. In recent years, the SWPCC has also monitored urban outfalls to the Truckee River to understand better changes to water quality resulting from storm events. TMWRF monitors the Truckee River at various points downstream of the urbanized area, as well as Steamboat Creek above and below the discharge point, to track potential water quality impacts on the river, per discharge permit requirements. The quality of the Truckee River water is monitored at treatment plant intakes by TMWA and Washoe County under the Safe Drinking Water Act. The Truckee River Flood Project monitors flows for flood prediction and future projects. The NDEP monitors streams, including the Truckee River, for purposes of assessing compliance with WQS for the Nevada Integrated Report.

Raising concerns over the health of the Truckee River, the Legislative Committee to Oversee the WRWC requested a bill draft in August 2008 for a Truckee River monitoring resolution. With the Legislative direction (BDR R-237, SCR-2), the NDEP gathered a working group to create a MOU to encourage entities that are engaged in water quality monitoring of the Truckee River to coordinate activities. With 14 signatories, the MOU, which expired in 2014, brought parties together, provided a platform for collaboration and quality control, provided a data clearinghouse for technical resources and dissemination of public information on the health of the Truckee River.

The TMWC, aka SWPCC applied to the NDEP for CWA Section 319(h) funding, and was awarded a grant to hire a consultant to facilitate the coordinated monitoring efforts. Reno, as lead agency for the TMWC, entered into a grant agreement with the NDEP for facilitation support. Reno managed a Request for Qualifications in 2009, and the Committee selected KJC to facilitate a process and create a Coordinated Monitoring Plan. With a full year of extensive technical meetings and compiling information KJC produced the Coordinated Monitoring Plan which was published in June 2011. This compendium may be found on TRIG at www.truckeeriverinfo.org/cmp.

4.5.7 Truckee River Information Gateway

Regional Stakeholders recognized a great need for a watershed clearinghouse for all stakeholders to share technical data, maps, and other valuable resources collected on the Truckee River and tributaries. The TRIG, www.truckeeriverinfo.org, was developed in 2004 by Ecological Resource Associates (“ERA”), primarily funded by Reno and Sparks, and has become the premier data gathering/sharing tool for technical users in the Truckee River watershed. This resource is intended to save time and local computing resources by providing a platform and online database to share valuable information and build better understanding of the Truckee River watershed’s complexity. The TRIG server is housed in the Information Center for the Environment at University of California Davis, where it is maintained seamlessly by ERA and updated routinely.

4.5.8 Truckee River Water Quality Monitoring Data

As required by NPDES permits to discharge to the Truckee River, Tahoe-Truckee Sanitation Agency (“T-TSA”) and TMWRF monitor water quality monthly at various points on the mainstem river and nearby tributaries. The following bar charts (Figures 4-3, 4-4 and 4-5) depict contaminants of concern per TMDLs set by the NDEP on the lower Truckee River. Constituents are measured at three locations: Farad (by T-TSA), and East McCarran and Lockwood (by

TMWRF). Chemical and biological indicators of water quality are included in data gathering efforts under permit. Data may be found on the TRIG website at www.truckeeriverinfo.org/data.

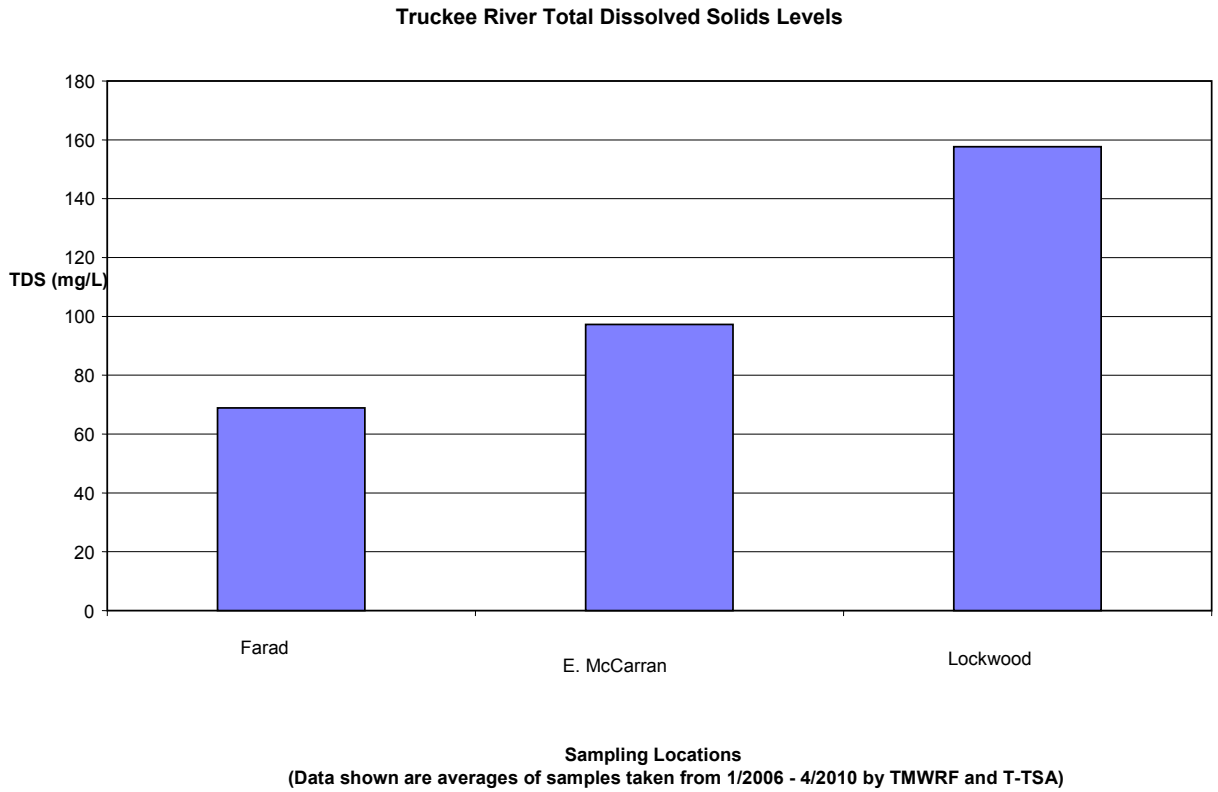

Figure 4-3 Total Dissolved Solids on the Truckee River

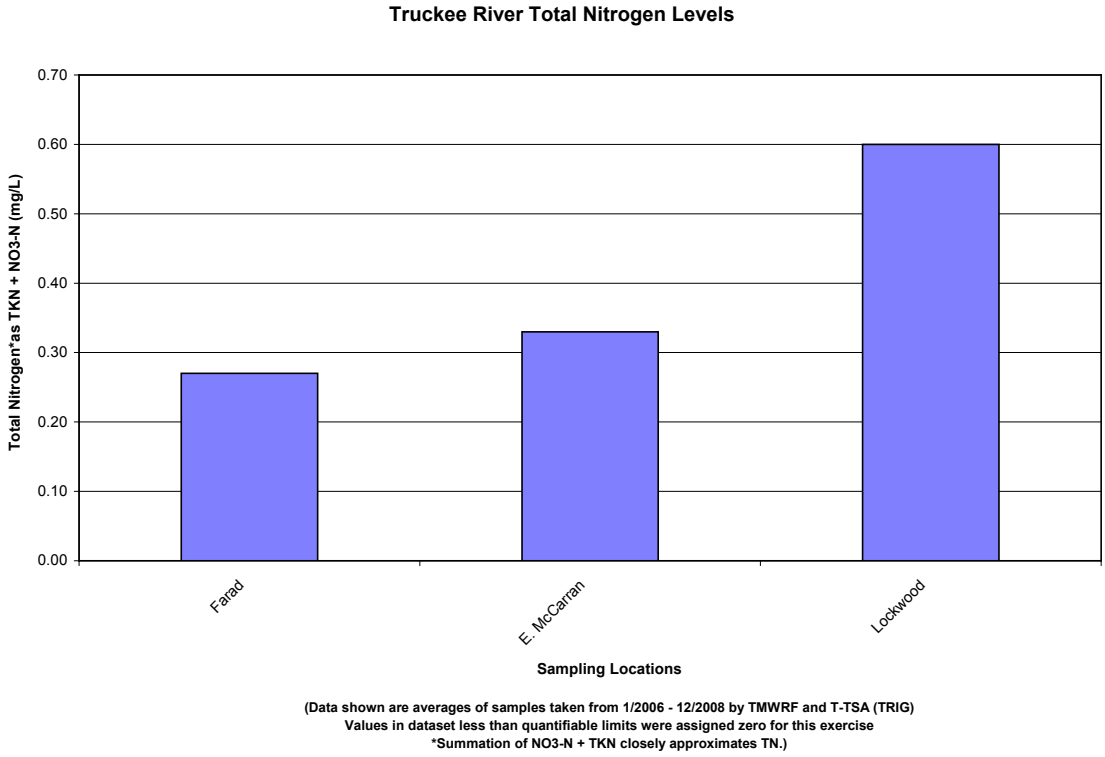

Figure 4-4 Total Nitrogen on the Truckee River

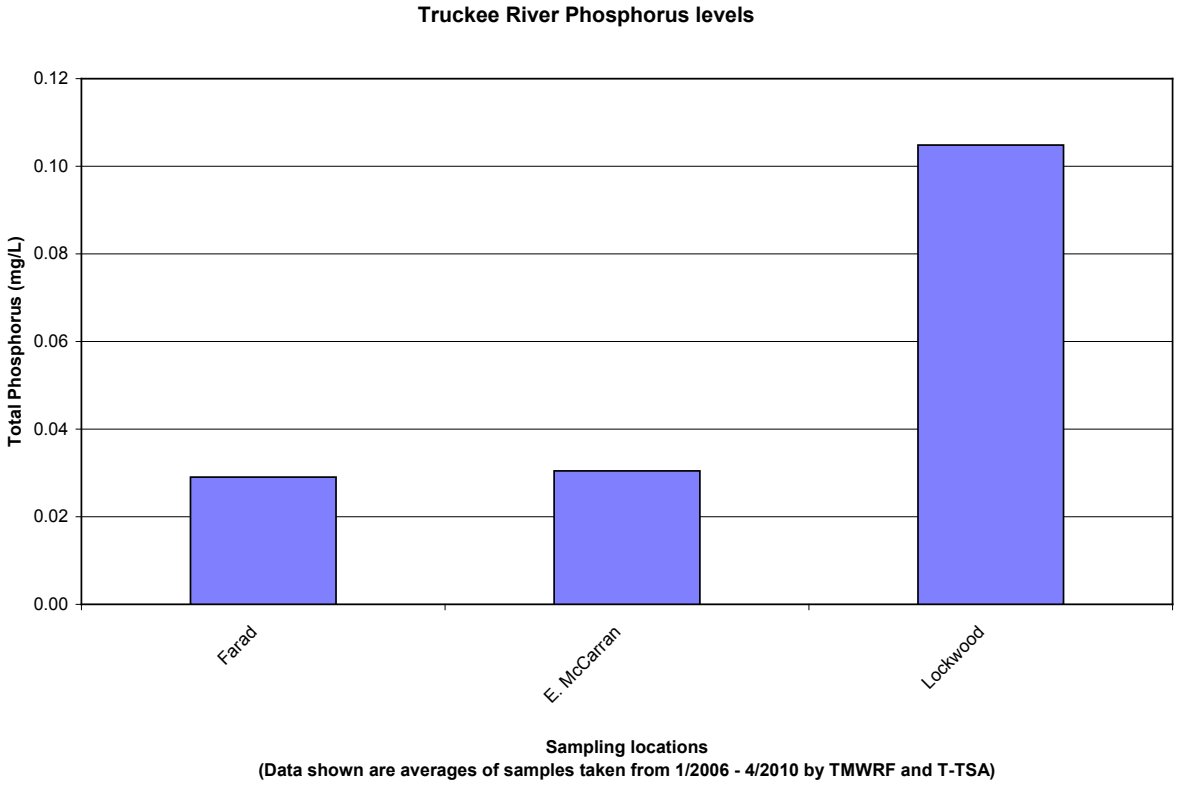

Figure 4-5 Total Phosphorus on the Truckee River

Referring to Figure 4-5 (a graph of average TP concentrations), it is evident that the WQS for TP is exceeded at Lockwood. The current TP WQS for the Truckee River at Lockwood, 0.05 mg/L, has been in place for many years and was based on non-site specific national standards. The TP WQS was derived from a national criterion designed for the protection of downstream lakes rather than from site specific criteria and riverine processes. Upstream of Lockwood at East McCarran, the Water Quality Standard for TP is 0.10 mg/L. The 2015 PLPT Water Quality Standard for P at the tribal boundary is expressed as 0.022 mg/L of DRP (or orthophosphate). The dissolved form of P is considered to be the readily bioavailable component. Given the variety of WQS for P throughout the Truckee River system, beneficial uses are being maintained upstream of East McCarran, but from Lockwood to the PLPT boundary the beneficial use criterion of 0.05 mg/L is consistently not being met.

Water quality at Farad, California just west of the state line, reflects water quality upstream of the Truckee Meadows, and is considered background water quality for the Truckee Meadows area. Monitoring results at East McCarran Boulevard in the east Truckee Meadows, reflect some changes to water quality that occur within the urbanized area. Results at Lockwood, below the Truckee River narrows east of Sparks, reflect the full water quality impact of the Truckee Meadows. Truckee River water quality reflects the national trends observed and reported by the EPA on waterways passing through urbanized areas.

Tributaries with high levels of P-containing compounds, identified by the NDEP and added to the Nevada 303(d) List, include Alum Creek (TP), Chalk Creek (Ortho P), and Whites Creek (TP)[4]. *Truckee River Water Quality: Current Conditions and Trends Relevant to the TMDL and WLAs* (Jassby et. al., 2007), includes a technical review that describes how the Truckee River behaves in response to nutrients (http://www.truckeeriverinfo.org/files/truckee/Jassby_2007_Truckee.pdf).

4.5.9 River and Stream Restoration

Stakeholders are actively engaged in restoration efforts on the Truckee River from Lake Tahoe to Pyramid Lake. Land uses (including flood control, irrigation, channelization, and urbanization with resulting hydromodification downstream) have greatly altered instream and adjacent riparian habitats. In some locations, such alterations to waterways have eliminated floodplains and meanders, causing steeper stream gradients, bank erosion, channel downcutting, lower stream bed elevations and lower water tables. Lowered water tables result in loss of streamside vegetation. In the Truckee River watershed, this has resulted in loss of shade, warmer in-stream water temperatures and subsequent reduced amounts of DO available for native fish communities. The reduced or absent riparian and in-stream complexity has caused a decline in habitat available to fish as cover, for spawning, and migration. The results of all this have led to the non-functional river and stream reaches observable today, necessitating watershed restoration efforts.

Tahoe to Verdi

The “middle” Truckee River, from Tahoe City to the Verdi area, has many beneficial uses and demands. Land uses include timber harvesting and ski resorts. The Truckee River Watershed Council is a California-based nonprofit organization committed to “collaborative solutions to protect, enhance, and restore the Truckee River watershed”, and facilitating partnerships to benefit the watershed. High priority projects are located throughout the middle Truckee River, and on tributaries feeding it, including restoration projects as well as behavior-changing education on BMPs.

[4] See Appendix G, NDEP comments.

Projects have been planned with a wide assortment of stakeholders and include meadow and riparian restoration to re-establish properly functioning conditions and reduce erosion; urban stream management using BMPs to reduce storm water pollution; stabilize banks of incised creeks; restore floodplain, habitat and agricultural lands; acquire, assess and restore key properties in the river canyon; improve roads to decrease sediment loads to streams and the river; map forest road and trail networks; upgrade and replace culvert and bridge systems; reduce fuels; and implement LID projects to recharge local aquifers, treat runoff and prevent hydromodification from urbanization wherever possible.

Truckee Meadows to Pyramid Lake

The Lower Truckee River, running from the Truckee Meadows metropolitan area to Pyramid Lake, is a vital resource that serves multiple public and private benefits. Due to significant channelization efforts during the 20th century much of the river between Sparks and Wadsworth has been highly degraded. The extent, size and condition of the riparian forest, and of bird, amphibian and native fish species, are greatly reduced compared to 19th century pre-settlement conditions. Restoration requires rebuilding the physical environment, especially to restore channel geometry and the connection of the river to the floodplain, and active reintroduction of native plants.

The Nature Conservancy ("TNC") began working in partnership with a team of public agencies toward a sustainable Truckee River from its headwaters in the Sierra Nevada to its terminus at Pyramid Lake. TNC has been working actively to restore key reaches of the lower river and floodplain since 2000 when it purchased the McCarran Ranch along five miles of the river. TNC's partner agencies each have their own distinct goals for the river, but as a whole they are compatible and mutually reinforcing: improve water quality, wildlife habitat and the fishery; flood protection; and opportunities for recreation.

Partner agencies include:

- BOR;
- Reno;
- Sparks;
- U.S. Bureau of Land Management ("BLM");
- USFWS;
- NDOW;
- Washoe County;
- Water Planning Commission; and
- Truckee River Flood Project.

The overall goal of TNC's Truckee River Project is to conserve priority native Truckee River plants and animals by protecting and restoring the lands and waters they need to survive. The project has two separate but integrated parts. On the lower river in Nevada, downstream of the Truckee Meadows to Wadsworth, TNC is implementing a large-scale floodplain acquisition and restoration program. The riparian forest and wetlands, and the birds that depend on them, are TNC's interests in the lower river. Restoration will also improve the river's ability to sustain a higher flow for eventual flood protection efforts in the Truckee Meadows. River restoration is considered a "non-structural improvement" in Reno and Sparks wastewater facility planning for water quality improvements. Reno and Sparks began participating in river restoration on the lower Truckee River in 2003 when the McCarran Ranch pilot project was initiated.

2002 Memorandum of Understanding

The three local governments and the PLPT have signed a MOU supporting the multiple goals to be achieved through river restoration acknowledging a regional collaborative effort to restore the lower Truckee River below Vista. The MOU generally describes the benefits, goals and management principles that the major stakeholders agree are necessary to develop a comprehensive program to restore the lower Truckee River.

The lower river falls under the jurisdiction of multiple local, state, and federal agencies and units of government, and involves multiple private landowners. To successfully take advantage of this opportunity, public agencies and private landowners needed to cooperate and coordinate their river restoration activities. This statement of public benefits, goals, and management principles agreed upon by key lower-river stakeholders, represented a common understanding and foundation from which more detailed work programs have been pursued with a high likelihood of success.

These goals and benefits are:

Public Benefits:

- Recreation, open space, fishing, non-motorized boating and activities that are fundamental to the region's quality of life;
- Water quality and the related wastewater treatment capacity of the region, which is fundamental to economic growth;
- Attenuation of peak flood flows for public safety and to protect private and public property and infrastructure; and
- Habitat and wildlife benefits for fish, birds, mammals and plant communities that are part and parcel of our region's natural heritage.

Public Goals:

- Mitigation of flood flows;
- Cost-effective wastewater quality treatment;
- Public recreation opportunities that are high quality, easy to access and ample in number; and
- Preservation and restoration of aquatic and terrestrial habitat in the river corridor.

Management Principles:

- The goals of public recreation, water quality, flood attenuation, and habitat restoration are, by and large, compatible;
- Planning and implementation efforts for any single public goal (e.g., flood protection) in the lower river corridor shall consider and be consistent with other public goals, private interests, regional economic growth and preservation of tax revenue and public fiscal capacity; and

- Coordination of lower river activities is highly desirable to achieve economies of scale and avoid potential conflicts.

Restoration Efforts

TNC's McCarran Ranch demonstration project began in 2001 with revegetation. In 2003, TNC and partner agencies implemented a $1.2 million one-mile pilot restoration project that included channel and floodplain restoration and additional revegetation.

From 2003 until November 2005, the Cities and TNC worked to implement the remainder of the McCarran Ranch restoration project under the auspices of an ACOE 1135 Ecosystem Restoration Project. Under that program, the Cities would have funded roughly 35 percent of the costs, and the federal government would have provided the remainder. In the aftermath of Hurricane Katrina, however, nearly all discretionary funds for the ACOE were redirected to the Gulf recovery effort, and the near term McCarran Ranch project funding was lost.

The Desert Terminal Lakes program was created by Senator Reid for purposes of restoring the health of Walker Lake and Pyramid Lake. The BOR issued a Request for Proposals in May 2005 for projects to improve the health and increase flow to Pyramid Lake and the Truckee River. Together Reno, Sparks and TNC were awarded $9.6 million to complete river restoration at McCarran Ranch and implement restoration at Mustang Ranch, Lockwood and below Derby Dam. To satisfy the requirement of the Desert Terminal Lakes grant program to increase flows to Pyramid Lake, the Cities committed 250 af of TMWRF treated effluent groundwater component to Pyramid Lake. An additional $five million of Nevada Question 1 funds, administered by Washoe County, has also been used to implement the program.

The entire McCarran Ranch site is 305 acres and has five miles of restored river. Habitat improvements include 120 acres of native plantings, 18 riffles, 11 wetlands, and improved channel sinuosity.

The Lockwood property, owned by Washoe County, is located about 10 miles downstream of Reno. Completed in 2009, the restoration includes a new river meander, eight riffles, two wetlands, and 28 acres of revegetation. The Lockwood restoration project also includes recreational elements such as a non-motorized, multi-use trailhead; onsite parking; restroom facilities; picnic tables; and interpretive signs.

Improvements at the Mustang restoration site completed in February of 2010 include new meanders in the river channel.

Below Derby Dam, the initial vision was an installation of a low flow channel to assist in fish passage. However, after the Environmental Impact Statement was completed, it was concluded that revegetation alone would be most beneficial. A revegetation and white top control project was launched in 2009.

Restoration at the BLM-owned 102 Ranch includes two new river meanders, six riffles, five wetlands, and 115 acres of revegetation.

NV Energy is collaborating with TNC on restoration on about 65 acres and a mile of river at Tracy. The project, initiated in 2013, includes five new river meanders, six riffles, one wetland and about 55 acres of revegetation.

Since 2003, 11 miles of floodplain along the lower river between Sparks and Wadsworth has been restored. Revegetation and establishment is ongoing and when finished, the restored sites will

improve fish habitat, boost water quality and allow floodwaters to spread naturally over the floodplain.

Collaboration and cost sharing by agencies, land owners and other stakeholders will, in many instances, help achieve the greatest river restoration benefits in a cost-effective manner. The following policy supports Truckee River restoration:

Policy 3.1.d: Truckee River Restoration

In review of proposed projects and proposed land use changes within the areas identified for restoration, the local governments shall make findings supporting the implementation of potential restoration projects as identified in the Lower Truckee River Restoration Plan and the TRFMA-approved Local Rate Plan.

Steamboat Creek Restoration

Several studies based on water quality monitoring data have shown that Steamboat Creek is a major contributor of non-point source pollution to the Truckee River. The pollution results from bank erosion, exotic weed populations, geothermal mineral deposits, irrigation return waters, urban storm water, and the cumulative impacts of human activities throughout the watershed. Steamboat Creek flows from Washoe Lake through Pleasant Valley, Steamboat Valley, and along the eastern edge of the south and central Truckee Meadows before discharging to the Truckee River. Steamboat Creek receives water from many streams flowing down the north Carson Range, including Browns, Galena, Jones, Whites, Thomas, Dry and South Evans Creeks, most of which have undergone significant urbanization in the last twenty years, changing their functionalities and increasing non-point source pollution.

Steamboat Creek restoration projects were evaluated and the sub-watershed assessed for feasibility and prioritization. Unfortunately, mercury has been identified in project reaches and creates a significant obstacle to restoration. Mercury is a neurotoxin, and once converted from elemental mercury to methylated mercury, effectively makes its way up the food chain. Mercury originated at Washoe Lake where Comstock-era gold and silver mills used the metal to process ore. Studies have also shown that geothermal areas in the Truckee Meadows are high in mercury, and that fish in Washoe Lake are recognized as containing high levels of methyl mercury. Projects implementing the Steamboat Creek Restoration Master Plan, including excavation and re-vegetation of new floodplains, would liberate mercury that is currently buried in sediment. In addition, wetlands creation may exacerbate the production of methyl mercury. These projects have been postponed indefinitely. Recent studies, however, indicate that streambank stabilization could reduce mercury loading to the creek.

4.5.10 Watershed Management and Protection in the Truckee Meadows

Watershed health is greatly dependent upon the integrity of riparian conditions, proper stream function and the absence of excessive erosion. In annual assessments, named streams have been rated for how well they behave as naturally functioning drainageways, and how vulnerable they are to degradation caused by improper adjacent land use. Year-by-year comparisons are made in annual assessments with recommendations for maintenance and restoration of each stream. The *Truckee Meadows Watershed Protection Manual* was developed by KJC in 2005. This manual, funded by the RWMF and the NDEP, was produced to establish the assessment protocol.

Watershed Assessments for Tributaries to the Truckee River

In 2002, Washoe County, the UNCE, and the Washoe-Storey Conservation District partnered to develop a Watershed Management and Protection Plan. The *Watershed Assessment for Tributaries to the Truckee River* (Widmer and Jesch, 2002), was published to provide the community a report card on the baseline condition of tributaries. Tributary creeks are shown on Figure 4-6.

It was suggested that comparing this baseline to current conditions of each tributary annually would provide decision makers, planners and regulators with relevant and up-to-date information concerning restoration, weed populations, opportunities for watershed protection, whether BMPs are mitigating storm water pollution, and locations for trails or other open space amenities. This report contains substantial mapping of geographic information and stream surveys noting the condition of the various stream reaches that were used to trace the sources of watershed problems.

The *Watershed Protection Manual* (KJC, 2005) provided a reference and compendium of watershed protection activities and programs developed in 2004 and 2005 for Reno, Sparks, and Washoe County. Twenty-five tributaries draining to the Truckee River were assessed initially in 2002, most of which have been assessed annually beginning in 2005. Upper, middle and lower creek reaches were established in 2002 and assessed on a rotating basis, funded by the TMWC/SWPCC:

- North Carson Range - Peavine Creeks: Hunter, Alum, Peavine, Mogul, Chalk, North Evans, Dog, Sunrise, Bull Ranch, and Towers/Roberts;
- Washoe Valley Creeks: Jumbo, Davis, Ophir, Winter, Lewers, Franktown, McKewen and Muskgrove;
- NTD; and
- South Truckee Meadows Creeks: Galena, Whites, Thomas, Jones, Bailey and Browns.

Watershed Assessments for Tributaries to the Truckee River (from 2005 through 2009) provide annual survey results for streams, including apparent hydrologic functioning patterns and trends for each stream, and prioritization for restoration. *The Watershed Protection Manual* identified methods available for evaluating stream health and reaches of each tributary for assessment. Information from the assessments has been used in the development of Reno's Truckee River Mapserver and Truckee River Watershed Map Tool. In an effort to involve more local experts in assessments, invitations are offered for volunteers to provide assistance. Team assessments are performed during summer months and scheduled to facilitate attendance of agency representatives.

In the *2009 Watershed Assessment* (Jesch and Jesch, 2009), the program was expanded to include water quality, geographic information system ("GIS") access, and six tributaries listed on the Nevada 303(d) List. Basic water chemistry measurements were made during one week in October, which included temperature, pH, electrical conductivity and DO in the streams. Photo points and assessment team observations were provided in a GIS database. This GIS data should facilitate a better understanding of specific locations, familiarity with the streams and watersheds.

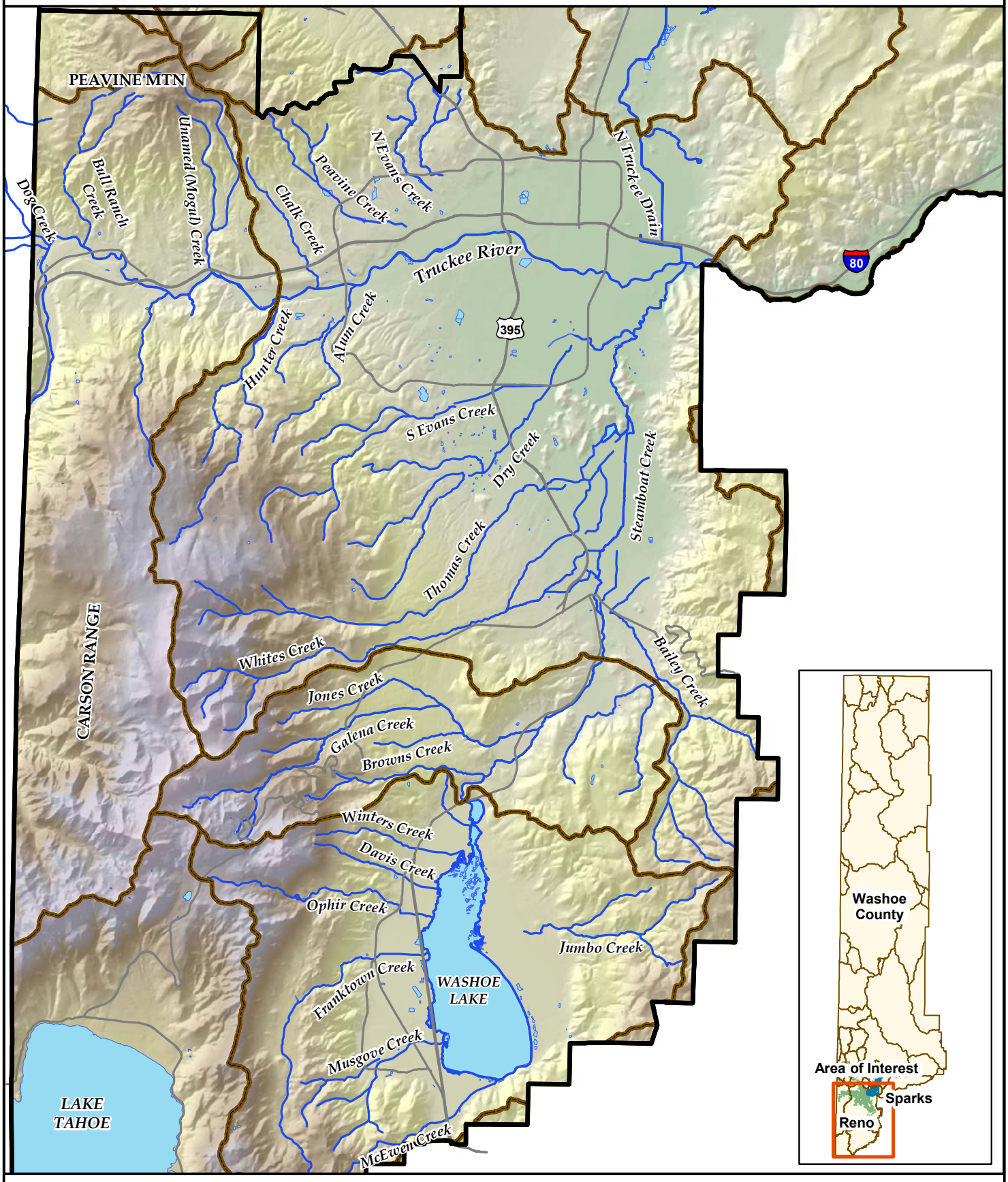

Figure 4-6 Truckee River Tributary Creeks in the Truckee Meadows

0 0.5 1 2 3 4 5 Miles

Notes: The Scale and configuration of all Information shown heron are approximate only and are not intended as a guide for design or survey work. Reproduction is not permitted without prior written permission from the Washoe County Department of Water Resources.
October 2010

Department of Water Resources
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Streams were assessed in groupings of geographic area, and ranked from low to high for restoration priorities. The NTD had no high priority needs in 2009. The Northern Carson, Verdi and Peavine Creeks had some high priority needs, including Alum Creek, Hunter Creek, and North Evans Creek. The Southwest Truckee Meadows watersheds had high priority needs also, including Jones Creek, South Evans Creek and Whites Creek. Washoe Valley streams had no high priority restoration needs, as all streams appear to be functioning properly. See Tables 4-3, 4-4 and 4-5 for these listings and action items established to restore stream and watershed health. CDM Smith was hired to perform the annual assessments using a mapping approach starting in 2015.

Table 4-3 Northern Carson, Verdi, and Peavine Creeks

Creek	Trend	Restoration Priority	Reshape Channel Banks	Restore Channel Floodplain	Restore Riparian Vegetation	Storm water Runoff Treatment	Control Encroachment	Reduce Lawn Care Chemicals	Control Invasive Weeds	Enforce Construction Site BMPs	Public Education	Limit Herbicide Applications	Monitor Water Chemistry	Monitor Channel Stability	Control Head-Cut Erosion
Alum Middle	Not Apparent	High			✓			✓			✓		✓	✓	✓
Alum Lower	Not Apparent	High			✓			✓			✓	✓	✓	✓	✓
Mogul Upper	Upward	Low													
Mogul Middle	Upward	Low											✓		
Mogul Lower	Not Apparent	Low	✓	✓			✓		✓				✓		
Chalk Upper	Not Apparent	Med		✓			✓	✓	✓	✓	✓				✓
Chalk Middle	Upward	Low							✓		✓	✓	✓		
Chalk Lower	Not Apparent	Med			✓	✓			✓				✓		
Hunter Middle	Upward	High				✓			✓						
Peavine Upper	Upward														
Peavine Middle	Downward	Med			✓		✓		✓		✓	✓			
N Evans Upper	Not Apparent	Med			✓				✓						
N Evans Middle	Upward	High							✓						✓
N Evans Lower	Upward	Low													
Dog Lower	Upward	Low							✓						
Roberts Lower	Not Apparent	Low	✓	✓	✓				✓						
Sunrise	Upward	Low							✓						

Source: Watershed Assessment for Tributaries to the Truckee River (Jesch and Jesch, 2009)

Table 4-4 Southwest Truckee Meadows Creeks

Creek	Trend	Restoration Priority	Reshape Channel Banks	Restore Channel Floodplain	Restore Riparian Vegetation	Storm water Runoff Treatment	Control Encroachment	Reduce Lawn Care Chemicals	Control Invasive Weeds	Enforce Construction Site BMPs	Public Education	Control Impacts From Vehicles	Monitor Channel Stability	Reduce Livestock Impacts	Monitor Water Chemistry
Browns Middle	Upward	Low													
Dry Middle	Upward	Med	✓	✓	✓		✓		✓		✓			✓	
Galena Middle	Not Apparent	Low	✓	✓	✓				✓						
Jones Middle	Downward	High	✓	✓	✓	✓	✓		✓				✓		
S. Evans Mid/Upper	Not Apparent	High	✓	✓	✓								✓		
S. Evans Mid/Mid	Varies	High	✓	✓	✓	✓			✓	✓				✓	
S. Evans Mid/Lower	Not Apparent	High			✓	✓			✓						✓
S. Evans Lower	Not Apparent	Low		✓	✓	✓							✓		✓
Thomas Middle	Not Apparent	Low							✓			✓			
Whites North Mid/Upper	Not Apparent	Low													✓
Whites North Mid/Lower	Downward	High							✓				✓		✓
Whites South Middle	Not Apparent	High	✓	✓	✓	✓			✓				✓		✓

Source: Watershed Assessment for Tributaries to the Truckee River (Jesch and Jesch, 2009)

Table 4-5 North Truckee Drain

Reach	Trend	Restoration Priority	Restore Low Flow Channel	Erosion Control Channel Banks	Restore Channel Floodplain	Restore Riparian Vegetation	Storm water Runoff Treatment	Control Encroachment	Reduce Lawn Care Chemicals	Control Invasive Weeds	Enforce Construction Site BMPs	Public Education	Treatment Basins	Monitor Water Chemistry	Monitor Channel Stability
NTD A Upper	Upward									✓	✓				
NTD B Middle	Upward									✓		✓			
NTD C Middle	Not Apparent	Med.		✓			✓		✓	✓		✓	✓	✓	
NTD D Lower	Downward	Low		✓		✓		✓		✓				✓	✓

Source: Watershed Assessment for Tributaries to the Truckee River (Jesch and Jesch, 2009)

As evaluated between 2005 and 2009, construction and development projects remain the largest single land use affecting stream health, when BMPs are not used to protect riparian buffer zones around streams. Encroachment at Jones Creek and Hunter Creek has caused dramatic changes in the stream zone in the affected area and downstream.

Reno and Washoe County have adopted watershed protection ordinances over the last few years, for example, the Reno Structural Controls Ordinance, passed in 2009. Waterways should, therefore, be better protected through local code enforcement. As the economy improves, development projects requiring mitigation of streams may be directed towards high priority stream restoration needs.

In 2010, the TMWC/SWPCC agreed to concentrate funds on evaluating tributaries impacted by development and reduce efforts on those tributaries emptying into Washoe Lake, which do not appear to be under development pressures.

4.5.11 Watershed Management and Protection Projects

Chalk Creek

Chalk Creek was identified in the *Watershed Assessment for Tributaries to the Truckee River* (Jesch and Jesch, 2009, and prior years) as contributing significant TDS, N, and P loads to the Truckee River. Levels of these three constituents have been measured regularly as one to two orders of magnitude higher than other tributaries in the Truckee Meadows. Chalk Creek is also included on the current Nevada 303(d) List. A Reno - Sparks cooperative monitoring program has been established And data collected and processed has been posted to TRIG.

Reno has implemented a three-part approach to assess possible options for reducing pollutants in Chalk Creek: (1) evaluate treatment options; (2) investigate pollutant sources; and (3) public outreach. Part one studied the feasibility of treatment technologies potentially available to treat

Chalk Creek water. The second investigated the source of contaminants with a complete Chalk Creek sub-watershed characterization. Part three, public education, targeted homeowners and large turf properties in the Chalk Creek drainage to encourage responsible outdoor water and chemical use (see Section 4.5.13, below).

ECO:LOGIC Engineering studied treatment technologies and concluded that a low-tech constructed wetland utilizing microbial action to reduce sulfate in the system would be most feasible and effective for treating TDS. Reno, using additional support from the Truckee River Fund and community volunteers, constructed a pilot-scale sulfate-reducing wetland in May 2010. As most of the TDS in Chalk Creek is in the form of sulfate, a reduction in TDS was expected as a result of sulfate reduction in the wetland. A cooperative venture with UNR provided monitoring for water quality and performance for a year. The technology proved to be less effective than anticipated and the project was discontinued.

JBR Environmental Consultants conducted a comprehensive watershed characterization and discovered that the system was historically ephemeral and that all warm weather flows are the result of irrigation. The study also revealed that Chalk Creek is located on a particularly vulnerable soil type which leaches salts and nutrients when heavily irrigated. Heavy development and turf planting were discovered to be a source of TDS and nutrients.

Alum Creek

Alum Creek was listed as high priority in the *Watershed Assessment for Tributaries to the Truckee River* (Jesch and Jesch, 2009) due to poor water quality. The creek has also been listed on the Nevada 303(d) List for *E. coli*, ortho-P, TP, TDS, TSS, turbidity, and metals (lead and iron). Alum Creek has a five-square mile watershed and flows over forest lands in the upper reaches, through the 2,300-acre creekside community of Caughlin Ranch and city park property before emptying into the Truckee River. This stream is atypical in that the majority of the irrigation season flow is diverted from Steamboat Ditch. High pressure utility lines buried in the creek are threatened by significant stream bank erosion caused by variable ditch water diversions and storm water runoff from impervious pavement flowing through a riparian zone that has been reduced in size and converted to turf grass landscape.

Reno staff initiated outreach to the Caughlin Ranch Homeowner's Association, which owns and maintains most of the middle watershed, to advise of the 303(d) listing and to seek cooperation in watershed protection. Also, UNR is interested in understanding the flow dynamics and began monitoring water levels and water quality in 2009. Data collected in 2010 will be necessary for designing effective restoration projects to stabilize the creek banks.

Stantec, with the Nevada Land Trust, completed an investigation of water quality conditions in Alum Creek and provided recommendations for mitigating the problems with proper storm water and land management practices (Stantec, 2014).

North Truckee Drain

The NTD has a drainage area of nearly 77 square miles, primarily in Spanish Springs Valley and Sparks, and an average streamflow of one to five cubic feet per second. The NTD has been recorded over time as having elevated levels of TN, TP, and TDS. The latest watershed assessment found an improving functionality trend over the last few years (Jesch and Jesch, 2009), with riparian and stream vegetation flourishing and providing habitat. The NTD Relocation Project, currently in the construction phase, is identified as a Truckee River Action Project. The

project will focus on flood mitigation by realigning the NTD and relocating the confluence with the Truckee River approximately 4,500 feet downstream.

4.5.12 Other Programs

Hill Slope Development

Truckee Meadows Regional Plan Policy 2.2.1 requires local governments to develop management strategies for areas with slopes greater than 15 percent but less than 30 percent within one year of adoption of the *Truckee Meadows Regional Plan* (TMRPA, 2002). Proposals for watershed changes in areas with slopes greater than 15 percent are of concern as they relate to subjects of the *Regional Water Plan*. Therefore, the management strategies that are developed as a requirement of Regional Plan Policy 2.2.1 shall be submitted to the NNWPC for review, comment and recommendation.

Policy 3.1.g: Management Strategies for Slopes Greater than 15 Percent

Local government management strategies for hillsides with natural slopes greater than 15 percent and less than 30 percent shall be submitted to the NNWPC for review, comment, and recommendations prior to incorporation into local government Master Plans.

Local government management strategies should ensure that:

- Activities comply with the terms of the storm water NPDES permits;
- Development on such slopes incorporates on-site and/or off-site mitigation measures for impacts to habitat and water quality;
- Ordinances are enforced with respect to erosion control and runoff;
- Local governments and entities with responsibility for the provision of utilities such as water, wastewater, and flood control services have identified the additional costs of infrastructure, operations, and maintenance associated with development in these areas, and said costs are economically feasible;
- Natural recharge areas are identified and protected; and
- An analysis is performed to identify flood and erosion hazard areas, and potential mitigation measures.

Noxious Weed Control

“The rapid spread of invasive species remains one of our country's biggest environmental problems, a situation complicated by the sheer number of invasive species, lack of a coordinated and comprehensive effort to prevent introductions, monitor and survey for new introductions, and the remarkable ability of invasive species to adapt, reproduce and ultimately overtake entire ecosystems” (Western Governor’s Association Policy Resolution 10-4). Invasive weeds are increasingly recognized as threats to water quality, wildlife habitat, recreational activities and the economic stability of the agricultural industry. They increase the cost of water purification, power generation and irrigation supply, reduce property values, and degrade ecosystem functions.

In 2004, in an effort to better coordinate the management of invasive weeds, the Truckee Meadows Weed Coordinating Group was formed. Members include federal agencies, state agencies, county and city parks and roads staff, environmental organizations, the UNCE, and others. Operating under an MOU and annual action plans, this group seeks grant funding to inventory, control and monitor weeds, as well as restore degraded sites. In 2009, a weed management plan was completed. No dedicated funds are supplied to the group. Projects include broad weed surveys in 2005 and 2007; weed mapping; guidelines on preventing the spread of weeds; weed treatment along tributaries to the Truckee River, as well as along the river; weed treatment in other areas, such as Swan Lake Nature Study Area; weed management and restoration of burned sites; a website with a weed reporting form; and broad public outreach. The group seeks to avoid duplication of efforts and strategically focus on those invasive weeds that represent the greatest opportunity for successful elimination, such as medusahead, as well as the species that impair riparian habitat. Reno is considering the use of mechanical control methods.

In 2010, with grant funds from the Truckee River Fund, a boat inspection program modeled on the program at Lake Tahoe was launched on Boca and Stampede Reservoirs and Independence Lake to monitor for invasive aquatic organisms including quagga mussels and Asian clams, as well as invasive aquatic weeds. If the Truckee River becomes infested with invasive mollusks, costs for water treatment and energy production are expected to increase sharply. A focus on proactive monitoring and prevention techniques will help reduce the threat of invasion, but the program requires continuing funding.

4.5.13 Public Outreach Programs

Non-point Education for Municipal Officials

The UNR Cooperative Extension houses and staffs the NEMO Nevada Program. NEMO has provided workshops and education for advisory board members, city councils, county commissioners, planners, engineers, and others since 2004. The program is funded via 319(h) grants from the NDEP. Free 3.5-hour trainings are offered in the spring and fall each year to help attendees understand the link between changes in land use and water quality impacts. The trainings focus on the use of LID as a tool for capturing and processing storm water. Beginning in the Truckee Meadows, the program has now expanded to include Douglas and Lyon Counties.

Many presentations have also been made directly to the state land-use planning advisory committee, advisory boards, planning commissions, conservation districts, river coalitions, landscape architects, master gardeners and others interested in strategies for managing storm water pollution. Special seminars address issues such as water harvesting, riparian buffers, and slope stabilization. In 2010, NEMO began offering free field trainings in the appropriate choice and correct installation and maintenance of construction site BMPs. The NEMO program also led a Riparian Buffers workshop in March 2010, the first of its kind in the Truckee Meadows.

Additional educational elements include a website (www.unce.unr.edu/nemo) that includes information on local LID projects, a photo gallery, a searchable database of plants for LID, and many publications and action guides. These publications are available upon request for use at public events.

River Permitting

Working in or around the Truckee River on restoration, flood control, and construction projects requires many permits, protective measures and monitoring to meet federal, state and local

guidelines and regulations. The RWMF funded the *Truckee River Restoration and Construction Site Permitting Handbook* (KJC, 2009), which includes a Permitting Process Flowchart to assist users in completing all required permits for river protection, available for download at www.tmstormwater.com or www.washoecounty.us/water/index.htm). In May 2009, the Handbook was used for a Working in the River and Permitting Workshop, offered in Reno to guide users through the Handbook and the permitting process. Along with development of the Handbook, mapping was created to show the regulatory authorities governing various reaches of the river from the state line to Pyramid Lake. This map has been integrated as an interactive tool in the Watershed Map Server (see below).

Watershed Map Server

The Reno Map Server is a tool available to all internet users through the Reno website (http://maps.cityofreno.net/). In 2007, sufficient interest built in extending mapping abilities to the watershed by incorporating tributaries to the Truckee River, including all creeks assessed in the Watershed Assessments (Jesch et. al., 2009). The City built a Watershed Map Server as part of the existing GIS tool, but took information directly from the Assessments.

The website (http://maps.cityofreno.net/watershed/) includes: Photos and photo points referenced on the map, introduction, assessment text of middle and lower reaches of each stream, and “tips to help your creek”. Individual maps may be accessed by creek name or region, and drilled down to an aerial photo at the greatest level of resolution. Technical users who understand GIS are able to optimize its use and the latest in upgrades to this system include a permit area portal. Parties looking at completing a construction, restoration, or flood project on a portion of the Truckee River, can access all permitting agencies for that location by zooming to “permit area”. This last section was completed to accent the River Permitting class offered in 2008.

Truckee River Watershed Map Tool

The Truckee River Watershed Map Tool was initiated by Reno, with support from the Truckee River Fund as an outreach tool targeting middle and high school students. The existing Map Server, as a GIS tool, was not readily usable by non-technical internet users. This interactive, intuitive map-based tool allows users to view and explore the creeks near homes and schools online. The tool includes vegetation, wildlife, photos from the *Watershed Assessment* (Jesch and Jesch, 2009), and other interesting facts about each subwatershed. This tool has been shared with teachers throughout the Washoe County School District and throughout northern Nevada.

Over 40 teachers throughout the Washoe County School District have been advised of this tool, while it was still in the production phase. Teachers will be trained on using the Truckee River Watershed Map Tool with students, as the last phase of this project. This will be completed in conjunction with existing trainings throughout the school district, as well as with environmentally-directed teacher trainings hosted by the NDEP such as Project Wet.

Chalk Creek Outreach

The watershed assessments have found that Chalk Creek in northwest Reno has elevated P, N and TDS. As part of a three-part approach to address this problem, Reno used Truckee River Fund support to retain Olsen and Associates to develop and implement a public outreach program, one of the three parts. The effort targeted residents and owners of large turf areas to encourage adoption of more responsible outdoor water and chemical use practices.

Initial meetings with residents emphasized a positive, stewardship-based message and avoided creating fear about contaminating the water supply. Owners of large turf areas were also identified. In addition, residents were surveyed concerning their knowledge of outdoor runoff and storm water pollution both before and after informational presentations based on the results of technical studies. Ninety-seven percent of post-presentation surveys indicated an increased awareness of what goes into neighborhood creeks and 82 percent agreed with the statement, "The presentation influenced me to change my watering, yard care and/or storage practices."

TMWA Outdoor Water Conservation

TMWA offers an online water efficient landscape guide for maximizing responsible water use in the desert, using the seven horticultural principles to reduce outdoor irrigation while providing a lush and attractive outdoor area. The vast array of informational topics covered in the interactive tool include: landscape design and proper planning, planning an efficient irrigation system, plant search (by exposure or other needs), soil improvement, mulching, planting and maintenance.

This online, interactive guide for homeowners can be found at www.tmwalandscapeguide.com/landscape_guide/interactive/index.php. TMWA also provides an incentive to reducing water use outdoors, the Water Efficient Landscape Awards. This annual competition has two categories for either design by homeowner or designer, and TMWA provides free community tours of the winners' properties the following year, to share the wealth of learning by seeing conservation in action.

TMWA Watershed Academy

TMWA is dedicated to educating our youth for better tomorrows. The watershed academy web site (http://www.tmwaacademy.com/index.shtml) is provided to inform students and teachers and to give them the skills and knowledge they need to become informed conservers and consumers. Educational curriculum is available for teachers to use with students in four grade ranges, from kindergarten through high school. TMWA routinely holds poster contests for students and the educational approach is a high TMWA priority in outreach. Resources available to teachers include lesson plans for each grade, as well as online tools for use with students, a library of TMWA and other water-related publications, and other resources.

One Truckee River Management Plan

The Truckee River Management Plan, with four primary goals and over 140 strategies and action items, is One Truckee River's first step toward achieving its broad vision for the Truckee River. Phase One covers the largely urban stretch of river from West McCarran Boulevard in Reno to Vista Boulevard in Sparks. The plan's primary goals are to:

1. Protect water quality and ecosystem health;
2. Create and sustain a safe, beautiful and accessible river;
3. Build an aware community; and
4. Ensure the sustainable management of the river.

Most of the Truckee River and the Truckee River corridor is managed and regulated by federal, state and local agencies. One Truckee River seeks to coordinate existing efforts rather than create a new regulatory agency. Some important efforts and programs included in the plan are already the responsibility of individual One Truckee River stakeholders, and will gain additional support and recognition through the plan. Other projects and tasks need additional partners and

support. Finally, the plan identifies gaps in priority areas where new programs should be developed to provide for long-term management and sustainability. Nine emerging issues have been identified by One Truckee River:

1. Water Quality
2. Social Issues
3. Stewardship
4. Ecosystem
5. Quality of Life
6. Public Safety
7. Funding
8. Recreation
9. Education

The One Truckee River Management Plan, Phase One, can be viewed at: http://onetruckeeriver.org/.

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