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Revisions to the Implementation Plan for Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River below E.V. Spence Reservoir

For Segment Number 1426

Distributed by the Total Maximum Daily Load Program
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ACRONYMS

BMP	Best Management Practice
CRMWD	Colorado River Municipal Water District
CWQM	Continuous Water Quality Monitoring
I-Plan	Implementation Plan
mg/L	Milligram per Liter
NPS	nonpoint source
QAPP	Quality Assurance Project Plan
RRC	Texas Railroad Commission
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSSWCB	Texas State Soil and Water Conservation Board
UCRA	Upper Colorado River Authority
USEPA	United States Environmental Protection Agency
WLA	Waste Load Allocation
WWTF	Waste Water Treatment Facility

Implementation Plan for Two Total Maximum Daily Loads for the Colorado River Below E.V. Spence Reservoir

Executive Summary

On February 7, 2007, the Texas Commission on Environmental Quality (TCEQ) adopted *Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E. V. Spence Reservoir.* The total maximum daily loads (TMDLs) address chloride and total dissolved solids (TDS) in Segment 1426, the Colorado River below E.V. Spence Reservoir. The U.S. Environmental Protection Agency (USEPA) approved the TMDLs on April 9, 2007.

On October 10, 2007, the TCEQ approved the *Implementation Plan for Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E. V. Spence Reservoir.* The implementation plan (I-Plan) described the steps the TCEQ and its stakeholders would take to achieve the pollutant reductions identified in the TMDL report, and outlined the schedule for implementation.

This revision to the I-Plan presents the status of various aspects of the I-Plan, describes implementation activities that have occurred to date and also those that are ongoing and/or are planned. It also presents recommendations brought forth at Coordination Committee meetings and those resulting from meetings of three work groups formed to facilitate this I-Plan revision. The work groups include: the Oil and Gas Workgroup, the Water Quality Workgroup, and the Brush Control Workgroup.

Status Overview of Implementation Activities

- A significant control action of the I-Plan was ensuring that the chloride and TDS concentrations in releases from E.V. Spence Reservoir remain at or below 550mg/L and 1537mg/L respectively. Due to drought conditions, no releases from E.V. Spence Reservoir have occurred since early 2009. A Memorandum of Understanding between the Colorado River Municipal Water District (CRMWD) and United States Fish and Wildlife Service will govern future minimum reservoir release requirements in support of the Concho water snake.
- A nonpoint source (NPS) grant from the TCEQ was assigned to the Texas Railroad Commission (RRC) to investigate salinity contamination associated with oil and gas production located upstream and downstream of E.V. Spence Reservoir. Investigations have been completed and final reports were submitted to the TCEQ. The results have culminated in the development and implementation of some recommended Best Management Practices (BMPs) while others are in the initial stages of implementation.
- The Texas State Soil and Water Conservation Board (TSSWCB) has completed a project entitled, “Targeted Brush Control in the EV Spence Reservoir Watershed” that was funded through a Clean Water Act Section 319(h) grant. The goal of the project was to chemically

treat salt cedar in riparian areas along the Colorado River and its tributaries below Lake J.B. Thomas to the E.V. Spence Reservoir. Through this project a total of 11,391 acres were treated from 2005-2007.

- Two continuous water quality monitoring (CWQM) sites installed by the TCEQ and maintained by the CRMWD were put in upstream of E.V. Spence Reservoir in November of 2004 to assist the CRMWD in managing water quality and flow releases. The one installed at Beals Creek Pump Station C716 was deactivated on February 11, 2012. The one installed at the Colorado River Pump Station C717 is still in operation.
- The RRC continues to identify improperly plugged and unplugged oil and gas wells, dry holes, injection wells, orphan wells, and abandoned shut-in wells. According to the RRC records, as of February 2014, there were 317 producing, 129 shut-in, and 77 injection wells (total-523) in Coke County. In Runnels County there were 517 producing, 281 shut-in, and 43 injection wells (total-841).

Overview of Changes, Revisions, Additions

- The individual waste load allocations (WLAs) for chloride and TDS included in the original TMDL have been changed twice and included in the Water Quality Management Plan Updates of July 2009 and January 2010. The first change eliminated the WLAs from the City of Winters, the City of Ballinger, and the City of Bronte. The second change increased the WLA from the City of Robert Lee from 585 to 674 lbs/day chloride, and from 1,917 to 2,568 lbs/day TDS.
- The chloride impairment in segment 1426 was removed from the 2012 303(d) list. However, it is assessing as exceeding the standard in data evaluations for the 2014 assessment.
- New Stream Standards have been proposed but have not been accepted by EPA. They are as follows:

WQ Proposed Changes	Current	Proposed
Chlorides	610mg/L	1000mg/L
Sulfates	980mg/L	1110mg/L
TDS	2000mg/L	1770mg/L

- For the RRC NPS 319 grant (Wendkirk Seep and Ballinger Seep) additional monitoring wells were drilled and monitoring events conducted, additional modeling is needed for BMP development at Wendkirk Seep, and the project team is currently developing a Quality Assurance Project Plan (QAPP) for additional work at each site.
- Due to program-wide budget cuts, the number of Clean Rivers Program (CRP) monitoring sites on the Colorado River has been reduced. In the FY 2013-2014 biennium, there was an across the board 10% cut to each of the Colorado River CRP program partners' budgets.

In collaboration with the TCEQ Basin 14 water quality assessor, those sites and assessment units that were deemed to be spatially located to provide the best assessment coverage for all river segments were retained as monitoring sites.

Coordination Committee Concerns and Recommendations

- The committee recommends the upland control of mesquite and juniper to increase base flows and groundwater recharge and thereby improve water quality.
- The committee recommends the control of salt cedar and willow baccharis along a relatively narrow corridor along the river and its tributaries. The committee also supports the treatment of salt cedar in the O.H. Ivie lake basin and recommends aerial spraying of salt cedar followed by the introduction of the appropriate species of salt cedar beetle for the segment 1426 watershed area.
- The committee expressed concern regarding a water quality problem at site 18338 located at the SH 208 bridge in Robert Lee and recommends an investigation of the source. The chloride and sulfate concentrations have been steadily increasing since 2009.

Water Quality Graphs

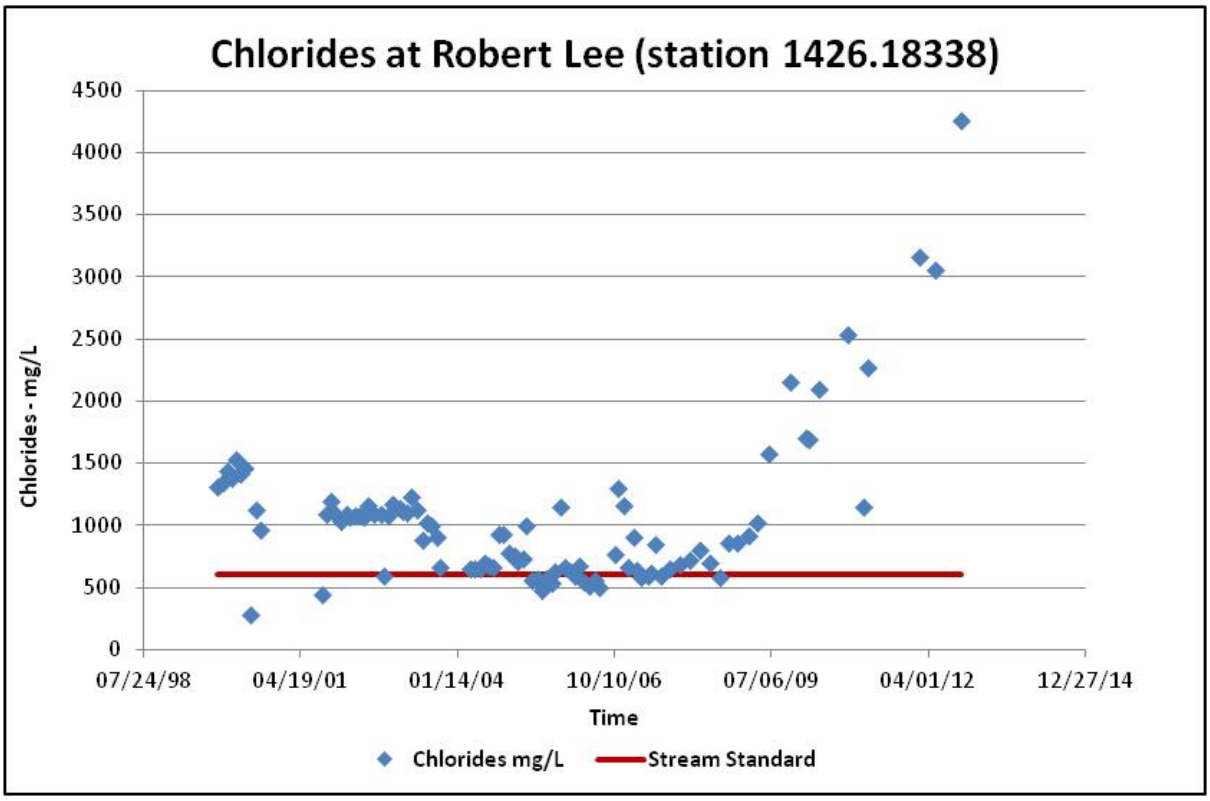

Figure 1. Chlorides at Robert Lee (station 1426.18338

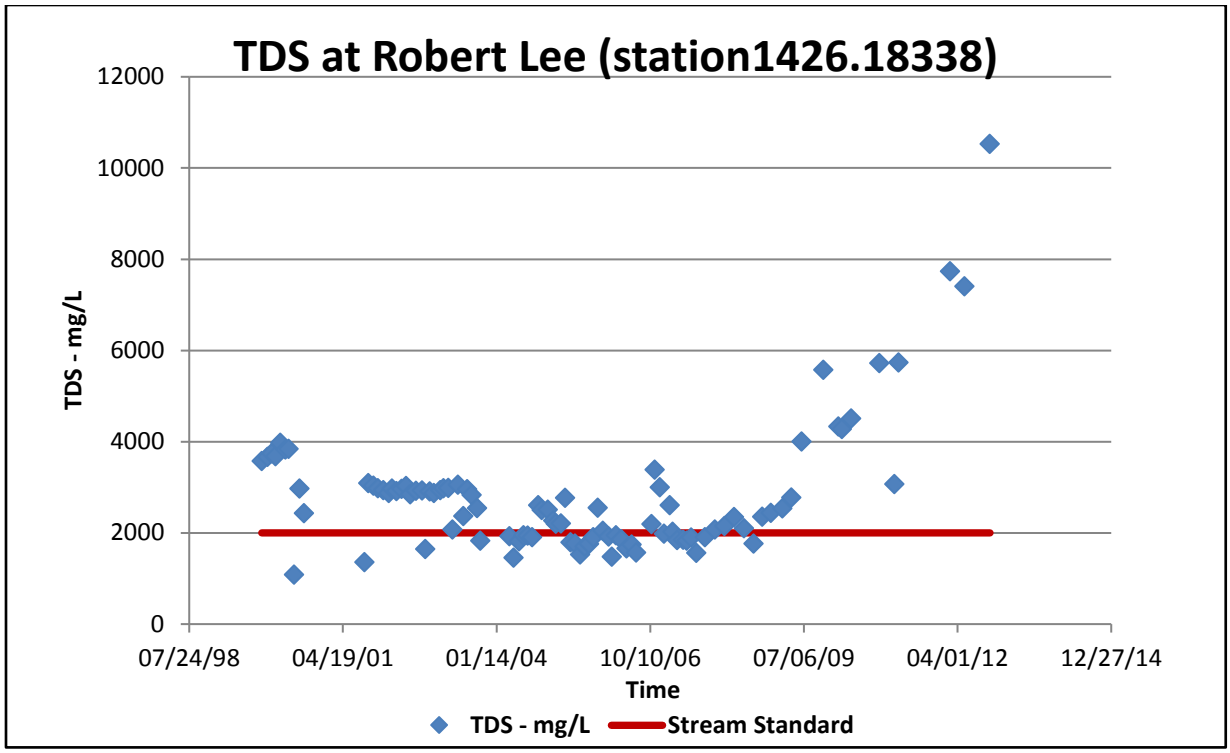

Figure 2. TDS at Robert Lee (station 1426.8338)

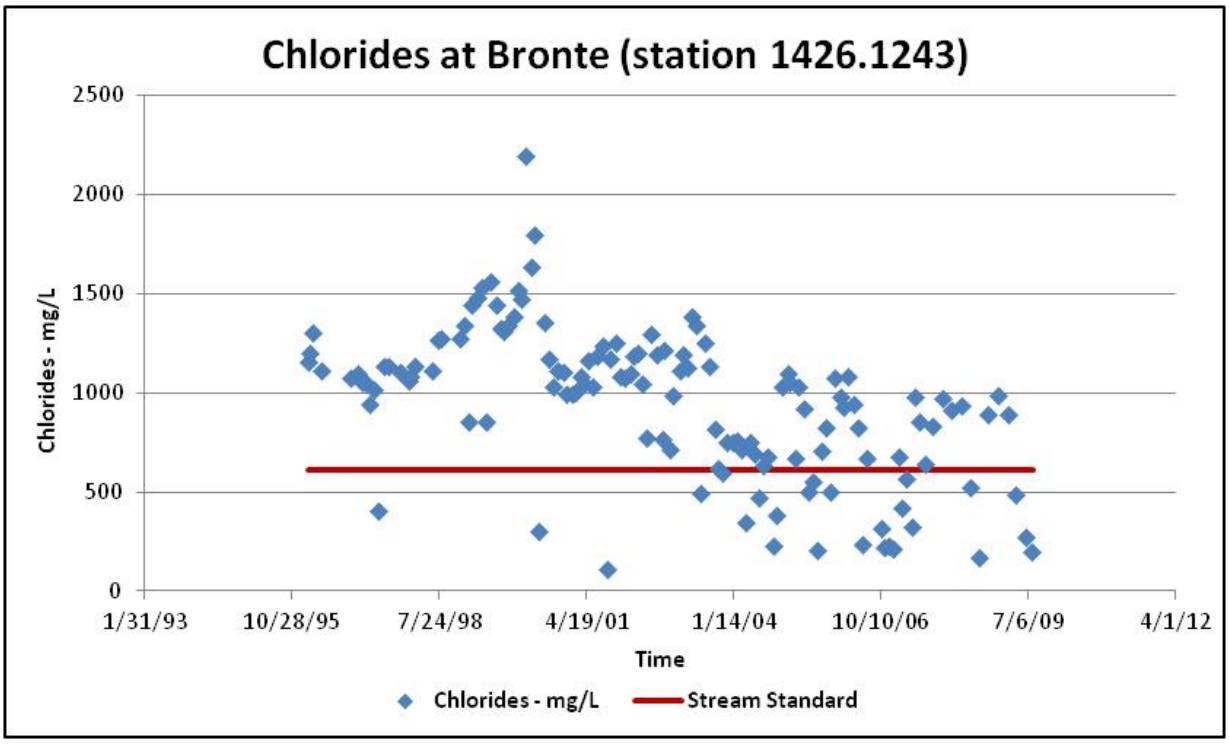

Figure 3. Chlorides at Bronte (station 1426.1243)

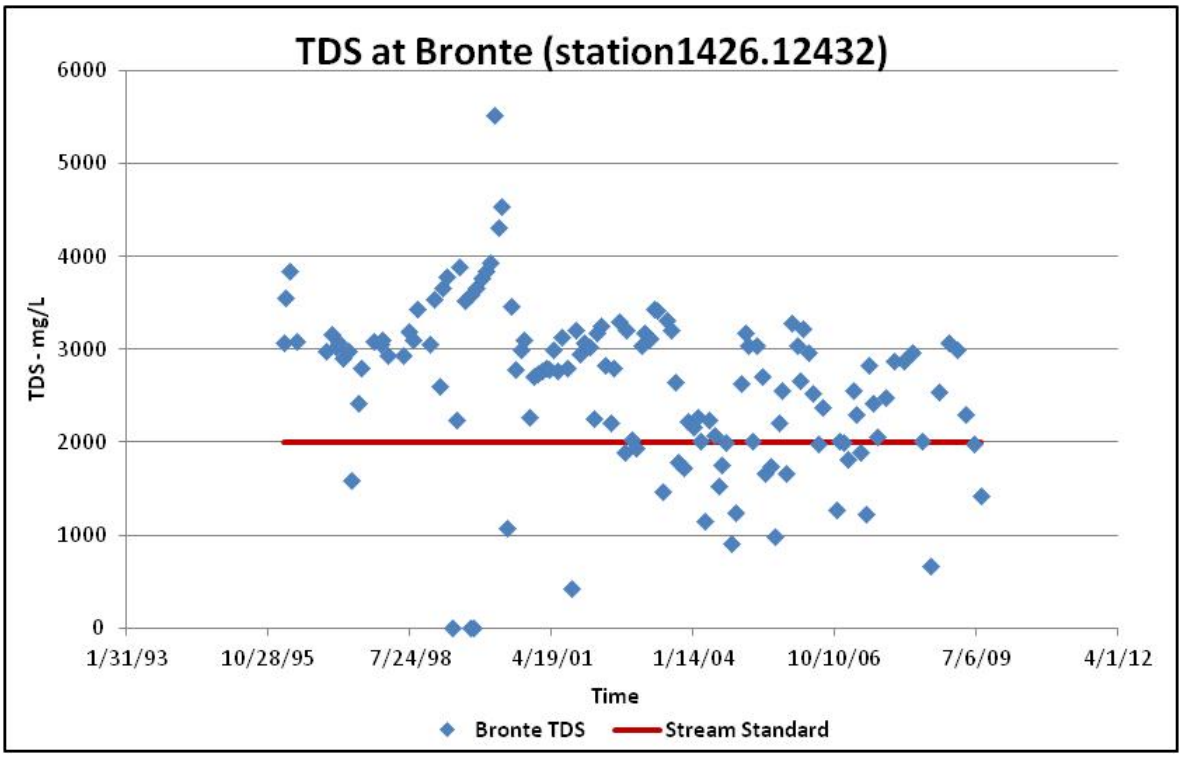

Figure 4. TDS at Bronte (station 1426.12432)

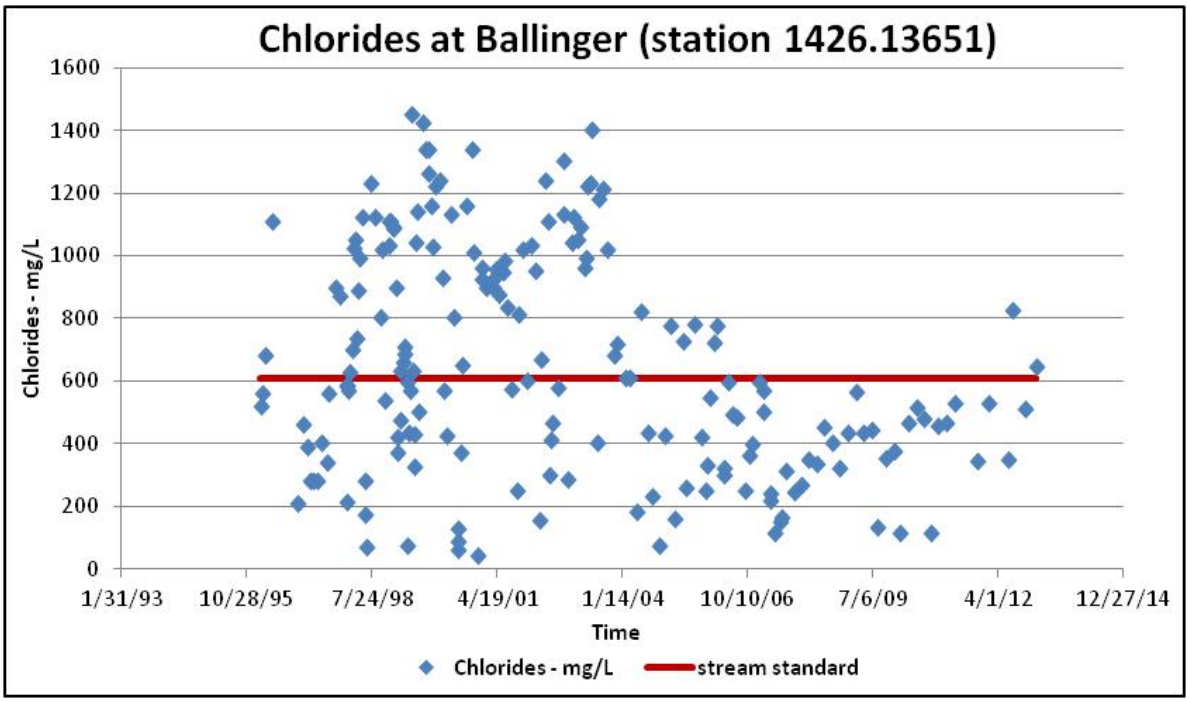

Figure 5. Chlorides at Ballinger (station (1423.13651)

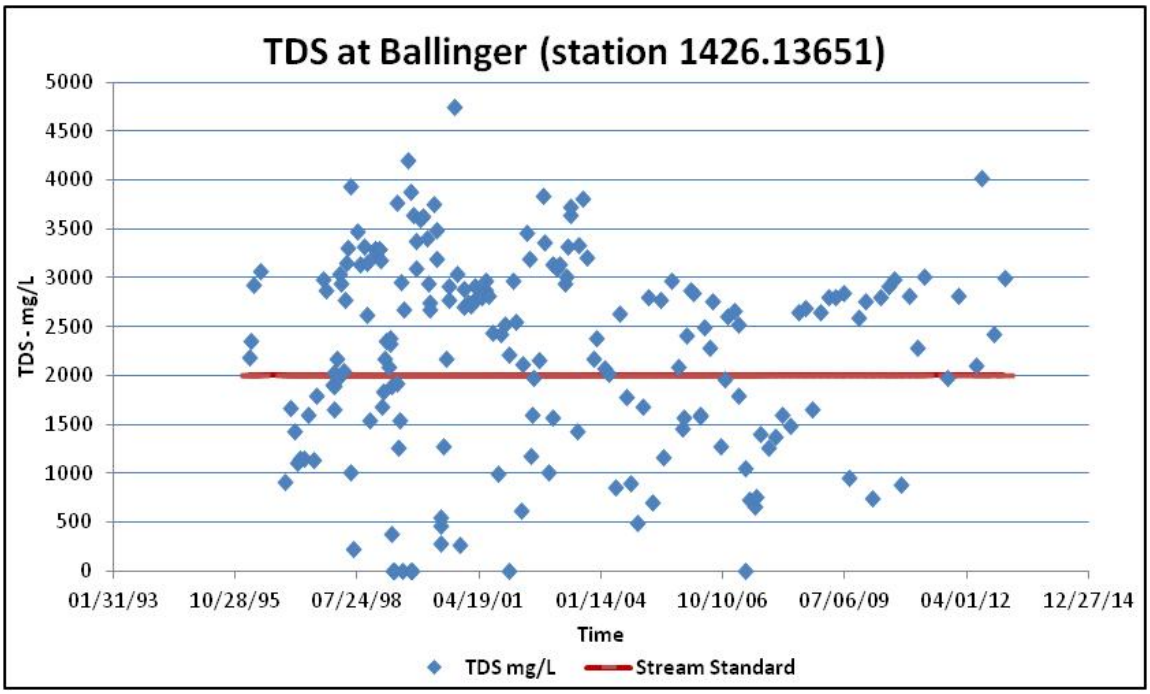

Figure 6. TDS at Ballinger (station 1426.13651)

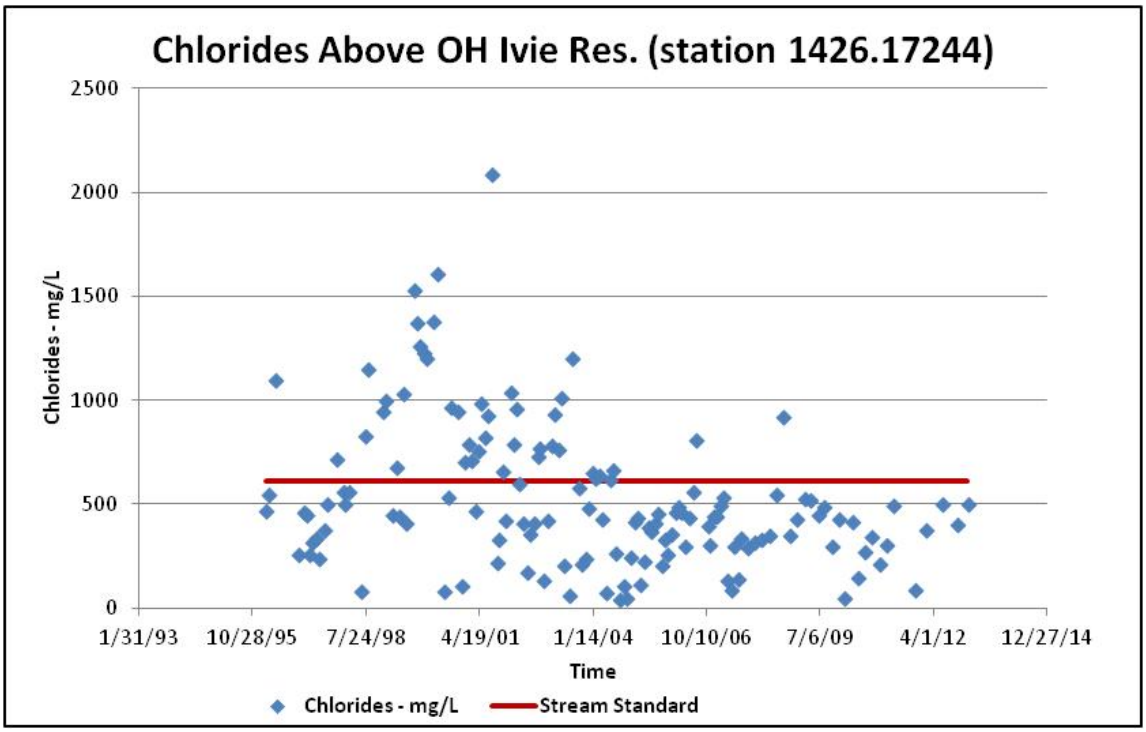

Figure 7. Chlorides Above OH Ivie Reservoir (station 1426.17244)

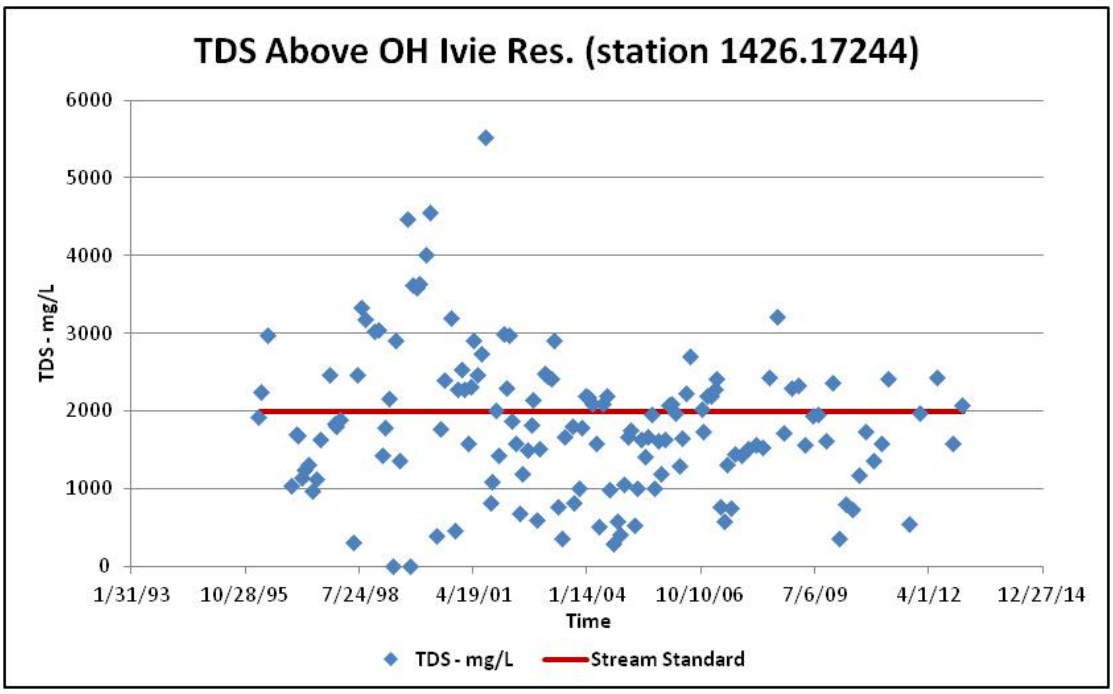

Figure 8. Chlorides Above OH Ivie Reservoir (station 1426.17244)

Implementation Progress

Management Measure 1.0: Targeted Brush Control (Salt Cedar) in E.V. Spence Reservoir Watershed

The TSSWCB administered both chemical and biological components in salt cedar control in Segments 1411 and 1412. These efforts were funded through federal Clean Water Act §319(h) nonpoint source grants from the U.S. Environmental Protection Agency coupled with appropriations from the Texas Legislature. The project utilized aerial application of *Arsenal®* herbicide in a narrow, riparian corridor along the Pecos and Colorado Rivers and their principal tributaries to control salt cedar. The multiyear project was active from 2003-2007 and treated a total of 11,391 acres of salt cedar above E.V. Spence Reservoir. It has been completed.

It is recognized that while chemical treatment provides rapid control, the life of a one-time chemical treatment is limited. In order to establish long-term, sustainable control of salt cedar regrowth, a biological control is an important follow-up component for long term efficacy. Recently, those involved in salt cedar beetle research have discovered several species of beetle, with some being better suited to this area of the country than others. Research is currently attempting to identify which beetle establishes and overwinters better in various geographical areas. Leaf beetle mortality and dispersal is being monitored as is the beetle's effectiveness at controlling salt cedar.

From 2006 through 2010, the Crete species of salt cedar beetle has been released in various numbers at several places along the Colorado River with mixed success. These beetles appear to

be less tolerant of cold temperatures than other species such as the Tunisian species. Hopefully, ongoing research will identify and delineate the various factors that will facilitate matching the hardiest, best performing beetle species with their optimal geographical areas.

Control Action 1.0: Investigations and Abatement of Loads from Produced Water and Seeps to Surface Water

The RRC initiated projects both above and below E.V. Spence Reservoir to investigate the nature and extent of known salinity contamination associated with oil and gas production, develop remediation/abatement alternatives or BMPs, and implement BMPs to specifically reduce the high salinity that contributes to water quality degradation.

Sites Located Upstream of E.V. Spence Reservoir (Segment 1411)

Several seeps in segment 1411 were targeted for investigation and abatement. The project encompasses areas commonly referred to as the West O'Daniel Seep, O'Ryan Seep, Pharaoh Seep and the Dugout Creek Alluvium.

The West O'Daniel Seep, which seeps water from the contact of an Ogallala Outlier and the Dockum Group, is located west of FM821 approximately 5.5 miles southeast of Coahama. Located in the same drainage and nearby, the Click and O'Daniel Seeps are included in the reporting of groundwater investigations and monitoring events.

Several groundwater investigations and monitoring events were conducted in the vicinity of the site. Five monitoring wells were drilled and installed to facilitate not only these studies, but also effectiveness monitoring once abatement activities began. After completion of various investigative events, the data were evaluated to determine appropriate BMPs. The BMP selected was an interception recovery trench. The trench was constructed and began operation in May of 2008. Reports on the RRC website provide loading calculations for the period May 19, 2008 to August 4, 2008. During that time period, a total of 17,309 lbs of chloride and 33,399 lbs of TDS were removed. Those amounts calculate to a daily rate of removal of 225 lbs/day of chlorides and 434 lbs/day of TDS. It is not reported how much longer the system operated.

The O'Ryan and Pharaoh Seeps are located approximately 3.5 miles southeast of Coahoma and are two of several saltwater seeps that discharge water into Dugout Creek, a tributary of Beals Creek. These seeps are included with the Dugout Creek Alluvium in reporting of investigations and monitoring events.

To facilitate groundwater investigations and monitoring events, in the third quarter of 2006, nine monitoring wells were drilled and completed. Initial investigations and follow-up monitoring events have been conducted to characterize the hydrology of the saline seeps. Potential BMPs have been evaluated and the projects are waiting for funding to install abatement systems.

Sites Located Downstream of E.V. Spence Reservoir (Segment 1426)

The principal areas of investigation in regards to the Ballinger Seep have taken place near Ballinger in Runnels County and the Wendkirk Seep located in the Wendkirk Oil Field that straddles the Colorado River between Bronte and Robert Lee in Coke County.

To facilitate groundwater investigations at the Ballinger Seep, seven monitoring wells were drilled and completed in July of 2006. Another ten monitoring wells were drilled in April and May of 2007. The evaluation of the results of monitoring events led to the isolation of an originally uncased cable tool well drilled in 1935 (Wolverton Well #1) as the most probable source of the saltwater feeding the seep. Although the well had been previously plugged by the RRC in 1998, groundwater monitoring results led to the determination that reentering and plugging the Wolverton Well#1 a second time was needed. After much trouble with drilling out junk and other difficulties, the well was finally plugged. The cost of plugging this one well totaled $70,975.

Currently, a QAPP is being developed for an abatement system to be installed at the Ballinger Seep site. An interception/recovery trench system is the chosen BMP for the next step in remediating this site. Major funding will be from a NPS 319grant.

At the Wendkirk Seep, nine wells were drilled and completed in 2006 and another nine in April of 2007. Based on initial monitoring events and investigations, the Mays-01 water well was thought to be an old cable tool oil well that had been improperly plugged back and converted into a water well. Plugging of this well was chosen as the first BMP needed for this project. However, when the well was reentered to be plugged it was discovered that it was a shallow well drilled as a water well and had not penetrated the Coleman Junction. No connection to deeper brine sources existed in the shallow water well. Therefore the high chloride water that was coming out of the seep and inside the wellbore was originating from some other source.

The BMP that included a recovery trench and storage system for disposal was based on the Mays-01 well being the source of the seep. Since this has been disproved, additional site investigation is necessitated. NPS 319 grant funds have been allocated and a QAPP is being developed for the additional investigative work needed to optimally locate a trench recovery system at the Wendkirk site.

These projects will enhance the pollution prevention efforts of the RRC and the TCEQ to restore and maintain the water quality in the Upper Colorado River Basin, upstream and downstream of E.V. Spence Reservoir.

Control Action 2.0: Well Plugging

The RRC worked cooperatively with the TCEQ to eliminate pollution caused by unplugged or improperly plugged wells and reduce the chloride content of the Upper Colorado River basin through a project called the “Runnels County/Upper Colorado River Saltwater Discharge Minimization Project.” Activity associated with oil and gas operations has been identified as possible sources of salinity. Such sources include abandoned, improperly plugged, or unplugged

oil and gas wells, and salt-water injection and/or disposal wells. A total of 183 wells of the 189 wells identified, recommended, and approved for plugging were plugged.

The RRC will continue to utilize State Clean Up Fund money to plug any eligible wells identified in the future for the Segment 1426 area.

Control Action 3.0: Reservoir Management and Continuous Water Quality Monitoring

In 2004, the TCEQ and the CRMWD deployed two monitoring stations in the Upper Colorado River watershed to accomplish four primary purposes:

- to continuously measure specific conductivity and therefore salinity, of water flowing from the upper watershed into E.V. Spence Reservoir, which discharges to Segment 1426 when not in drought,
- to identify and track trends in water quality,
- to determine the effectiveness of the practices implemented to reduce salinity, and
- to assist the CRMWD in diverting highly saline flows away from E.V. Spence Reservoir, and therefore Segment 1426 as well.

The CRMWD operates a "diverted water" supply system to prevent highly mineralized surface water that occurs routinely under base-flow and low-flow conditions in the Colorado River and Beals Creek (a tributary to the Colorado River) from reaching E.V. Spence Reservoir. Poor quality surface water is captured and pumped to nearby storage reservoirs for evaporation. The less-saline water experienced during high or flood flow conditions is allowed to bypass the pumping station and travel downstream to E.V. Spence Reservoir.

The Surface Water Quality Monitoring Team of the TCEQ's Water Quality Planning Division coordinates all aspects of managing the continuous monitoring stations. The monitoring stations were located at the Beals Creek Pump Station, southeast of Big Spring and the Colorado River Pump Station, northwest of Colorado City. Both stations were operated and maintained by the CRMWD staff. However, in February of 2012 the CWQM site at Beals Creek was deactivated, presumably due to the persistent drought conditions. The other site is still operational and allows users to review, customize, and generate a data report of the continuous data generated in real-time. This capability enhances the CRMWD's ability to expeditiously manage their water diversion system, ultimately leading to water quality improvements. Implementation of this action is funded through a federal grant authorized under Section 106 of the Clean Water Act.

Implementation Strategy for the Revised I-Plan

In May of 2013 the Upper Colorado River Authority (UCRA) began working on the project with the TCEQ to assist stakeholders in evaluating the current status and progress that has been made in carrying out the efforts delineated in the I*mplementation Plan for Two Total Maximum Daily Loads for Chloride and Total Dissolved Solids in the Colorado River Below E.V. Spence Reservoir*. The UCRA, along with TCEQ personnel, lead the effort in determining if and how the I-Plan should be revised.

Because stakeholder participation is crucial to the long term implementation of plans to improve water quality, the initial challenge was to form a watershed coordination committee comprised of local stakeholders. To this end, the UCRA issued press releases to newspapers and/or radio stations in Ballinger, Bronte, Robert Lee and San Angelo. A list of the former members of the stakeholder group that was involved in the development of the original TMDLs and I-Plan was used as a starting point to re-engage stakeholders. Local government entities were contacted directly and those attending the first meeting of the Coordination Committee were encouraged to spread the word to other interested stakeholders.

A strategy of the Coordination Committee was to organize three work groups to evaluate the progress made on the tasks relevant to each work group's area of interest. Each of these groups was tasked with making actionable recommendations to the Committee members. The three work groups formed were the Water Quality Workgroup, Oil and Gas Workgroup and Brush Control Workgroup. Each of these work groups held meetings at which various issues were discussed and tasks assigned to individual members. After agreement was reached among work group members on the needed changes and recommendations, UCRA personnel drafted the changes into report format. This was distributed to work group members and TCEQ personnel for comment, prior to presentation to the Coordination Committee.

After the proposed revisions and additions from the work groups were presented to the Coordination Committee, and after discussion and comments were received, those revisions that were approved by a majority vote of the Committee were included in the final I-Plan Revision. The final Revised I-Plan document was then submitted to TCEQ.

Adaptive Implementation

WLA Allocation Changes

One of the key elements in an Implementation Plan is the necessity to monitor implementation progress and adapt to changing conditions should they occur. Several changes have occurred since the October 2007 approval by the TCEQ of the original Implementation Plan. These are discussed below.

In the 2009 Update to the State Water Quality Management Plan, the WLAs from the City of Winters, the City of Ballinger and the City of Bronte were removed from the WLA table. This was done to reflect actual conditions in the watershed, i.e. waste water effluent from each of these community's treatment plants had Texas Land Application Permits and therefore were not contributing to the Waste Load Allocation through wastewater discharges to Segment 1426.

In the 2010 Update to the State Water Quality Management Plan, the WLA from Robert Lee was increased from 585 to 674 lbs/day of chloride, and from 1,917 to 2,568 lbs/day of TDS. This was a result of elevated salinity in the source water used for domestic supply by the city. The water was coming from E.V. Spence Reservoir, which at the time was essentially an evaporation pond. As the amount of water in the reservoir decreased from use and evaporation, the levels of chlorides correspondingly increased rendering it impossible for Robert Lee to meet the originally

assigned WLAs. To solve the problem, loading from the Allowance for Future Growth category was reassigned to the WWTF's WLA category.

The WLAs were manipulated to reflect the new assumptions. The City of Robert Lee now receives high quality treated water from the City of Bronte, and elevated chlorides from the water supply source is no longer an issue.

Delisting of Segment 1426 for Chlorides

In the 2010 assessment, chloride was removed from the 303d list as an impairment in Segment 1426. However, since then, chlorides are again elevated to the point that the segment is currently assessing as non-supportive and will likely be placed on the 2014 303d list. If this information is recognized, the TMDL for chlorides will once more need to be met through implementation of the original control measures and the ones newly identified in this I-Plan revision.

Stream Standards

New water quality standards have been proposed for segment 1426 but have not been accepted and approved by EPA. Should the new higher proposed value for chlorides and lower proposed value for TDS be approved by EPA, the TMDLs will need to be revised.

Railroad Commission of Texas NPS 319 Projects

Remediation work at the Wendkirk and Ballinger Seeps was included in the TMDL Control Measures. The original NPS projects were supposed to be concluded by 2007, but are still ongoing. Currently the RRC is working on QAPPs for the Wendkirk Field Seep and the Ballinger Seep.

The Ballinger Seep is nearer to the actual construction phase of the recommended BMP of a groundwater recovery trench. According to RRC staff, the Wendkirk Seep will require additional modeling before finalizing BMP selections. It is not possible to predict loadings reductions and resulting from these activities without conducting an HPSF model run with input from the BMP implementation. However, once BMPs are in operation, actual measured loading reductions will be calculated and documented by the RRC.

Fewer Sample Sites

Most of the Segment 1426 water quality data is collected through the Clean Rivers Program. Although the program has never received a budget increase in its 20 plus year history, it has managed to maintain (and in some cases even increase) the scope and reach of its water quality monitoring programs. However, in the most recent biennium, budget cuts in State Government affected the Clean Rivers Program. The result for Segment 1426 was a reduction from twelve sites routinely monitored, to the current eight sites from which water quality samples are collected and analyzed. Going forward, there is no choice but to function with the reduced data set.

Control Actions/Management Measures Added in This I-Plan Revision

The following management measures and control actions are recommended by the Coordination Committee and the various workgroups.

Recommended Management Measure 2.0
Targeted Brush Control of Upland Mesquite and Juniper

The Coordination Committee recommends the upland control of mesquite and juniper to increase base flows and groundwater recharge and thereby improve water quality. The Committee is aware that in 1999 the TSSWCB conducted among others, a feasibility study of the Upper Colorado River and Middle/South Concho River watersheds, including lake basins of O.H. Ivie Reservoir, E.V. Spence Reservoir, Lake J.B. Thomas, Twin Buttes Reservoir, and Lake Nasworthy. The Committee is also aware that the TSSWCB's Water Supply Enhancement Program now requires that a modeling study be performed on any proposed brush control project.

This management measure requires the financial participation of landowners who must share in the costs of brush treatment. It is considered likely that the drought conditions of the last many years may make it difficult for most landowners to participate in cost share programs, however it remains a recommendation of the Coordination Committee for this project.

Recommended Management Measure 3.0
Targeted Brush Control (Salt Cedar and Willow Baccharis) in Segments 1426 and 1433

The I-Plan Revision Coordination Committee and Brush Control Workgroup members strongly recommend chemical salt cedar treatment followed by biological control as a management measure. The Coordination Committee recommends the control of salt cedar and willow baccharis along a relatively narrow corridor along the river and its tributaries.

It is recommended that an effort similar to Management Measure 1.0 (described above) be conducted in Segment 1426 and 1433 followed by the introduction of salt cedar beetles at the optimum time for control of re-growth.

The Committee is aware of the feasibility study that is currently underway at the O.H. Ivie Reservoir (Segment 1433), and strongly supports the chemical control of salt cedar in the lake basin and up the waterways where salt cedar and willow baccharis are present.

If salt cedar and willow baccharis in the O.H. Ivie Reservoir lake basin is treated, then in becomes imperative that the watershed area of Segment 1426 also be treated to reduce and control the seed source.

Recommended Control Action 4.0 Investigation to Discover Pollutant Source and Development of Abatement Plan for the Elevated Chlorides at Site 18338

Site 18338 is located immediately downstream of the SH 208 bridge over the Colorado River near Robert Lee. The chloride concentrations at this location have steadily increased since the summer of 2009 (see Figure 2) and remain elevated.

The Committee recommends that a source determination study be implemented in the area of site 18338, and that once it is identified, the development of a BMP(s) to abate contributions from the source.

Table 1. Summary of Nine Key Elements

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Causes/Sources of Impairment **Targeted Critical Areas**	**Management Measures**	**Estimated Potential Load Reduction (lbs/Year)**	**Technical and Financial Assistance Needed for Each Measure**	**Education Component for Each Measure (and Other Education)**	**Implementation Schedule**	**Interim, Measurable Milestones for Each Measure**	**Indicators to Measure Progress**	**Monitoring Component**	**Responsible Entity**
Salt Cedar Segment 1426 Watershed	**Management Measure 1.0 Targeted Brush Control (Salt Cedar) in E.V. Spence Reservoir Watershed**	Chloride: 4.29E+04 TDS: 1.20E+05	Section 319 Nonpoint Source Grant	TSSWCB webpage	Completed	Acres of land treated (11,3691 acres treated)	Reduction in chloride and TDS related concentration	Continuous monitoring and routine basin monitoring	TSSWCB responsible for implementation UCRA and TCEQ responsible for routine basin monitoring
Mesquite and Juniper Segment 1426	**Recommended Management Measure 2.0 Targeted Brush Control of Upland Mesquite and Juniper**	Reduce concentrations of chlorides and TDS through introduction of higher flows	TSSWCB Water Supply Enhancement Program, NRCS programs, landowner participation	TSSWCB webpage	Contingent upon applications and TSSWCB ranking, priority, and approval	Acres of land treated	Increase in base flows and reduction in chloride and TDS related concentration	Continuous monitoring and routine basin monitoring	TSSWCB responsible for implementation UCRA and TCEQ responsible for routine basin monitoring
Salt Cedar and Willow Baccharis Segments 1426 and 1433	**Recommended Management Measure 3.0 Targeted Brush Control of Salt Cedar and Willow Baccharis in Segments 1426 and 1433**	Not available, will be based on model results	TSSWCB Water Supply Enhancement Program Section 319 Nonpoint Source Grants, NRCS programs	TSSWCB webpage	Contingent upon applications and TSSWCB ranking, priority, and approval	Acres of land treated	Reduction in chloride and TDS related concentration and increase in base flow	Continuous monitoring and routine basin monitoring	TSSWCB and UCRA responsible for implementation UCRA and TCEQ responsible for routine basin monitoring

Causes/Sources of Impairment Targeted Critical Areas	Management Measures	Estimated Potential Load Reduction (lbs/Year)	Technical and Financial Assistance Needed for Each Measure	Education Component for Each Measure (and Other Education)	Implementation Schedule	Interim, Measurable Milestones for Each Measure	Indicators to Measure Progress	Monitoring Component	Responsible Entity
Oil and gas operations in the Wendkirk Oil Field and the Ballinger seep and/or dissolution of gypsum from the San Angelo Formation Segment 1426 (Machae Creek Area (Wendkirk Field) and Ballinger Seep area)	**Control Action 1.0 Investigations and Abatement of Loads from Produced Water and Seeps to Surface** Groundwater investigations leading to selection and implementation of BMPs in the Wendkirk Oil Field and the Ballinger seep	Chloride: 9.53E+06 TDS: 5.86E+06	Section 319 Nonpoint Source Grants	Project status and results reports available electronically via the project web-page	2007 -2009 Work ongoing at Wendkirk Field and Ballinger Seep – Recovery trenches to be installed Currently writing QAPPS for additional GW investigations and BMP installs	Completion of GW investigation at Wendkirk Field Installation of recovery trenches at both sites	Installation and operation of recovery trenches Eventual reduction in TDS related concentrations from strategic deployment of BMPs	Routine basin monitoring	RRC responsible for GW investigations and implementation of BMPs UCRA and TCEQ responsible for routine basin monitoring
Produced water from leaking wells	**Control Action 2.0 Well Plugging** Runnels County/Upper Colorado River Saltwater Discharge Minimization Project Two wells plugged as result of GW investigations conducted in Control Action 1.0	Included in Control Action 1.0 numbers	Section 319 Nonpoint Source Grants	Project status and results reports available electronically via the project web-page	Completed Ongoing through RRC Oilfield Cleanup Program	Numbers of wells plugged	…Saltwater Discharge Mimization Project has been completed. 183 out of 189 wells plugged Wolverton No.1 plugged at Ballinger seep (2008) Mays-01 plugged at Wendkirk Seep (2008)	Routine basin monitoring	RRC responsible for GW investigations and implementation of BMPs UCRA and TCEQ responsible for routine basin monitoring

Causes/Sources of Impairment Targeted Critical Areas	Management Measures	Estimated Potential Load Reduction (lbs/Year)	Technical and Financial Assistance Needed for Each Measure	Education Component for Each Measure (and Other Education)	Implementation Schedule	Interim, Measurable Milestones for Each Measure	Indicators to Measure Progress	Monitoring Component	Responsible Entity
Carbonate Dissolution Segment 1412 and 1411 WQ releases from E.V. Spence Reservoir in Upper Colorado River Watershed	**Control Action 3.0 Reservoir Management and Continuous Water Quality Monitoring** Maintain operation of CWQM sites Reservoir management	Chloride: 5.60E+05 TDS: 1.57E+06	Section 106 Water Pollution Control Program Grant	TCEQ web-page and LCRA basin highlights report	2007-ongoing 1 CWQM site still operational No releases from Spence since early 2009 Management of WQ of releases will resume if lake elevation of 1843.5' is reached	n/a	Reduction in TDS related concentrations	Continuous monitoring and routine basin monitoring	Monitoring performed by UCRA and TCEQ Reservoir management by CRMWD
Source unknown at present	**Recommended Control Action 4.0 Investigation to Discover Pollutant Source and Development of Abatement Plan for the Elevated Chlorides at Site 18338**	Subject to findings	Section 319 Nonpoint Source Grant	Subject to findings and pollutant source	UCRA to seek funding for a source determination groundwater investigation	Completion of completion investigation	Receipt of funding Implementation of groundwater investigation	Routine basin monitoring and additional monitoring needs to be determined	UCRA

Implementation Tracking

This I-Plan Revision includes provisions to track the progress of the plan using both implementation and water quality indicators. These terms are further defined as:

- Programmatic Indicator – A measure of administrative actions undertaken that results in an improvement in water quality.
- Water Quality Indicator – A measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, and water quality standards.

Implementation tracking provides information that can be used to determine if progress is being made toward meeting goals. Tracking also allows stakeholders to evaluate actions taken, identify those which may not be working, and make any changes that may be necessary to get the plan back on target. The RRC, UCRA, and TCEQ will work collaboratively to ensure monitoring data are assessed to track progress.

Programmatic Indicators

Several monitoring and remediation projects are planned or underway as part of this implementation plan. Additional details of the various monitoring efforts are described in the "Water Quality Indicators" section of this document.

The TCEQ and its stakeholders will further evaluate the need for, and effectiveness of, the various mitigation and remediation options, and site-specific natural attenuation, based on periodic evaluation of monitoring results. Timetables for additional monitoring and/or the implementation of any BMPs, and estimates of the time necessary for restoration of the general use, will be further developed as the results of the ongoing monitoring are known. Interim evaluations will be made as appropriate, with final evaluations to be performed following completion of ongoing and scheduled efforts.

Water Quality Indicators

Verification that designated uses have been restored requires the measurement of applicable water quality indicators. The measurable outcome of all phases of this I-Plan Revision shall be the attainment of the TMDL endpoints for chloride and TDS in Segment 1426.

Through Clean Rivers Program routine monitoring, the UCRA will monitor chloride and TDS concentrations in surface water at several stations in Segments 1411, 1412, and 1426. Conductivity in the upper Colorado watershed above E.V. Spence Reservoir will also be monitored continuously via one CWQM site. Progress related to these environmental indicators will be analyzed by the UCRA and TCEQ.

Review Strategy

The TCEQ project manager and stakeholders in TMDL Implementation Projects periodically assess the results of the planned activities and other sources of information to evaluate the adequacy of this I-Plan Revision. This is usually in the form of an annual check-in meeting. Stakeholders

evaluate several factors, such as the pace of implementation, the effectiveness of best management practices, load reductions, and progress toward meeting water quality standards. The TCEQ project manager will document the results of these evaluations and its rationale for maintaining or revising elements of the I-Plan Revision, and will present them as part of the state's normal reporting process, as summarized in the following section.

Communication Strategy

Communication is necessary to ensure that stakeholders understand the I-Plan Revision and its progress in restoring water quality conditions. The TCEQ project manager will work with the local project contractor to disseminate the information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, nongovernmental organizations, and individuals. Though management measures and control actions are underway, a phased approach has been selected to determine the progress of this I-Plan Revision. Implementing TMDL plans under the phased approach establishes a timetable for the evaluation of management measures, data collection, the assessment for water quality standards attainment, and if needed, additional predictive modeling. If monitoring determines that the measures underway are not sufficient to achieve water quality standards, then the next phase of management practices shall be implemented.

The evaluation of management measures for Colorado River Below E.V. Spence Reservoir will be scheduled into three separate phases.

- Phase I of Implementation Plan progress began upon adoption (2007) of the plan by the Commission.
- Phase II will commence after six years (2013) with a revision to the plan which addresses changes in the watershed and evaluates the plan's progress to date.
- Phase III will begin after seven years (2014) of implementation to determine whether the BMPs have improved water quality sufficiently to achieve water quality standards.

Results, progress, and updates on these analyses will be provided to stakeholders on the TCEQ's project webpage. Regionally, the status progress of this Implementation Plan will be reported in the annually prepared Basin Highlights Reports and in the Basin Summary Reports prepared every five years by the Lower Colorado River Authority under provisions of the Texas Clean Rivers Program.