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OWRB
WATER RESOURCES BOARD
the water agency

Oklahoma Comprehensive Water Plan

River Basin Water Allocation Modeling Report

May 2010

This study was funded through an agreement with the Oklahoma Water Resources Board under its authority to update the Oklahoma Comprehensive Water Plan, the state's long-range water planning strategy. Results from this and other studies have been incorporated where appropriate in the OCWP's technical and policy considerations. The general goal of the 2012 OCWP Update is to ensure reliable water supplies for all Oklahomans through integrated and coordinated water resources planning and to provide information so that water providers, policy-makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

Oklahoma Comprehensive Water Plan
OCWP

IMPORTANT NOTICE

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ACRONYM LIST

For the purpose of this report, the following terms in quotation marks are defined as:

Term	**Definition**
“OWRB”	Oklahoma Water Resources Board
“OCWP”	Comprehensive Water Plan
“AF”	Acre-Feet
“AFY”	Acre-Feet in a Year
“SW”	Surface Water
“AGW”	Alluvial Groundwater

1.0 INTRODUCTION

In 2006, the Oklahoma Legislature appropriated funds for an update of the Oklahoma Comprehensive Water Plan (OCWP), to be completed in approximately five years. Implementation of the Comprehensive Water Plan involves policy development informed by technical studies. Technical studies consist of four principle elements: current and projected water demands; water supply availability; public water supply assessments; and technical studies in support of water resources management. The foundation of the technical studies are the estimates of water supply and water demands, including projections of future water use, which inform an assessment of the adequacy of future water supplies.

The adequacy of future water supply is evaluated using an analysis tool that compares projected demands to physical supplies for each of 82 delineated stream basins. This tool will assist with the detailed examination of demands and supplies, identification of areas of potential water shortages, and evaluation of potential water supply solutions. Watersheds in which demands are expected to exceed physical supplies will be identified, indicating areas of potential shortages. For those areas identified as having gaps in supply vs. projected demands or that face other identified water supply issues, initial water allocation modeling will be performed to gain a better understanding of the water management options in a particular basin. AMEC has previously completed stream water allocation models for the Oklahoma Water Resources Board for Muddy Boggy Creek, the Kiamichi River and the Little River. The work described herein involves refinements and additions to those water allocation models to include analysis scenarios that are consistent with the gap analyses conducted as part of the OCWP.

The project objective was to create a new set of scenarios and options for the Oklahoma Water Resource Board (OWRB) water allocation models that would facilitate comparison of results with those of the OCWP gap analysis model. Subject basins were Muddy Boggy Creek, the Kiamichi River and the Little River basins, water allocation models of which had been developed for the OWRB by AMEC. The water allocation models allow the OWRB to:

calculate historical water depletions (consumptive uses) in each of the basins,

simulate various water use scenarios, and

allocate water among permit holders

The scenarios developed for this project build upon these existing models.

The changes to the water allocation models required to make them consistent with the OCWP gap analysis involved adjusting the historical water use data and incorporating scenarios that represent water use data for future planning periods used in the OCWP. The OCWP process evaluates future water use every decade beginning in 2010 and extending to 2060; a subset of these projected future water use scenarios, 2010, 2030 and 2060, were developed for evaluation in the water allocation models.

Modeling was conducted using the December 2009 versions of the OWRB ExcelCRAM water allocation models for the Muddy Boggy, Kiamichi and Little River systems. Water supplies in each of the three basins were evaluated against the four OCWP demand scenarios (including a calibration level). Small increases in shortages were seen in the 2010, 2030, and 2060 scenarios along with reduced flows at the USGS gages at the bottom of the basins. The shortages in these scenarios that occurred to permit holders were due to localized shortages or reservoir operations and most of the impact from the increased demands appear at the USGS gages at the bottom of the basins.

2.0 REVISIONS TO WATER ALLOCATION MODELS

The historical scenario used in the OWRB water allocation models differed in some details from the historical scenario developed for the OCWP, so it was necessary to develop an historical scenario in the water allocation model that was substantially consistent with the historical water uses on which the OCWP analyses were based. Once the OCWP historical scenario was developed then it was a straightforward process to incorporate OCWP projected water uses for 2010, 2030 and 2060.

2.1 Simulation of Water Use and Allocation

The OWRB water allocation models use diversions as inputs, but represent water demands internally as calculated depletions (consumptive uses). The depletions are calculated within the model by multiplying the diversion amount by a consumptive use fraction. This calculation yields the depletions by use type that must be met with surface water or alluvial groundwater sources. Estimates of current and projected water use were provided in the OCWP in terms of diversions.

In both the OWRB water allocation models and the OCWP analyses, water uses are expressed as annual volumes (representing either average annual water use or a time series of annual water use); these annual volumes are broken down to monthly volumes by multiplying the annual volume by twelve fractions that represent the fractional monthly water use pattern.

Prior to development of the OCWP water allocation scenarios the OWRB reconciled the consumptive use fractions and the fractional monthly water use patterns between the OWRB water allocation models and the OCWP analyses, so both analyses now use the same consumptive use fractions.

Representation of water use as depletions is consistent with an assumption that return flows accrue within one month (the time step used in the allocation models) to locations within the same 12-digit HUC, which is the spatial resolution used by the model. Exceptions to this assumption cause effects that are probably much smaller than the uncertainty in estimates of water use.

The models compute shortages to demands as water is allocated according to water right permit date. The amount of a shortage is expressed in terms of consumptive use. To express a shortage as an estimate of the amount of water that could not be diverted from the river, the shortage expressed as consumptive use should be divided by the consumptive use fraction for that use type. For example, if the consumptive use fraction is 0.5, a shortage of 100 acre-feet of consumptive use would represent a shortage of 200 acre-feet of diversion; in some cases this calculation will understate the actual shortage to diversion amounts.

2.2 Simulation of Groundwater Use

The OWRB water allocation models and the OCWP analyses represent surface water and alluvial groundwater as a single water source. This representation is consistent with an assumption that water used from alluvial wells will impact the surface water system within one month (the time step used in the allocation models) at points within the same 12-digit HUC, which is the spatial resolution used by the model. Exceptions to this assumption cause effects that are probably much smaller than the uncertainty in estimates of water use.

The OCWP analyses included water from deep aquifers that are not closely connected to the surface water systems. The OWRB water allocation models do not simulate water supplied from deep aquifers. Water use from deep aquifers will not directly impact surface water supplies, but return flows from these uses will accrue to streams and alluvial groundwater systems. Return flows from historical use of deep groundwater will tend to increase estimates of natural flow, and future uses from deep groundwater may reduce future shortages at some locations.

OCWP broke down the total amount of water use for a particular use type into the quantity that came from surface water and alluvial systems and the quantity that came from deep groundwater. This breakdown was reported as the “source supply fraction” for a use type. The source supply fraction for a water use type was multiplied by the total estimate of water use for that water use type to determine the estimated amount of water that would be used from the surface water/alluvial system. Water use from the surface water/alluvial system was represented in the OCWP water allocation scenarios.

2.3 Natural Flows and Study Periods

The naturalized inflows in the three OWRB water allocation models were left unchanged and used with the new historical and projected water use scenarios developed from the OCWP report. The demand levels from the OCWP report were run against the full modeling periods (Table 2-1) and the results were analyzed for shortages to water right permits and changes in gage flows at the bottom of the USGS gages in the basin models.

Table 2-1: Table of model run periods.

Model	Modeling Period (calendar years)
Muddy Boggy Model	1950-2008
Kiamichi Model	1950-2007
Little River Model	1950-2008

2.4 Revisions to the Historical Water Use Scenario

The OWRB water allocation models represent water use as a monthly time series at individual permits, whereas the OCWP represents water use aggregated to a basin or sub-basin level, and as an average monthly pattern of use. The OWRB water allocation models represent three scenarios, an historical scenario, a full-permit scenario and a current-use scenario while the OCWP represents a current-use scenario and several projected future scenarios. The basis for the current-use scenarios in the OWRB water is average water use over the lifetime of the permit, while the basis for the OCWP current-use scenario is water use in 2007. Revisions to the OWRB water allocation models were required to develop a current-use scenario that was consistent with that used in the OCWP. Once the "OCWP current-use" scenario was developed it was a straightforward process to incorporate the OCWP projected water use scenarios.

Depletions representing water use were calculated by taking OCWP diversion data and applying the OCWP source supply fractions to obtain the estimate of water used from the surface/alluvial system. The water allocation model then multiplied the diversion amount by the consumptive use fraction to determine depletions that must be met with surface water or alluvial groundwater sources. These calculations were done for each OCWP sub-basin and each use type. These depletion values were then used as the basis for developing the detailed inputs used by the water allocation models.

The OCWP Historical Scenario was based on water use in 2007. OCWP water use estimates and projections were broken down by use type but were aggregated to a basin or sub-basin basis. Thus, it was necessary to relate the basin-scale estimates from the OCWP to individual permits represented in the OWRB water allocation models. This was done based on the 2007 water uses represented in the OWRB water allocation models. For each river system the 2007 water use from the OWRB water allocation model was compared to the basin wide totals in the OCWP. The 2007 water use generally compared well with the totals from the values in the OCWP report for 2007 as shown in Table 2-2.

Table 2-2: Comparison of Model 2007 Water Use and OCWP 2007 Historical Scenario.

River System	Model 2007 Historical Depletion (water year)	OCWP 2007 (SW & AGW) Depletion (water year)	Differences (Model - OCWP)
Muddy Boggy	86,413 AFY	85,198 AFY	1,215 AFY (+1%)
Kiamichi	8,983 AFY	8,184 AFY	799 AFY (+9%)
Little River	20,683 AFY	21,562 AFY	-879 AFY (-4%)

Prior to making the comparison in Table 2-2, one change was made to the 2007 water use in the Muddy Boggy Model. In its Historical Scenario, the City of Oklahoma City is shown to have depleted only approximately 6,777 AFY against their permit 19540613, which has a capacity of 31,367 AFY in 2007. In developing the OCWP Historical scenario, this was revised to a more realistic value of 31,370 AFY which is the amount depleted in 2003 and 2008. Table 2-2, above, reflects this change.

In modifying the Muddy Boggy, Kiamichi and Little River basin models we built the new OCWP scenarios into the existing model files using a new scenario number (5) selectable on the Input Controls worksheet in the models. This allowed the model to run any of the existing scenarios or one of the OCWP scenarios. To run an OCWP Scenario, the user selects the OCWP scenario number (5) and chooses an OCWP demand level from a drop down list of years (2007, 2010, 2030 or 2060).

2.5 Allocating OCWP Demands within Model Basins

The data for demands from the OCWP Water Demand and Supply Handbook provided total demands by use type in sub-basins for each model basin. In order to use the OCWP study demands in the water allocation model, which takes individual water right permits, the OCWP demands were prorated among the permits in the sub-basins based on the 2007 percentage of the water right permits in the sub-basin, further sub-divided by use type.

The correspondence between the spatial scope of the OWRB water allocation models and the sub-basins used in the OCWP are shown in Table 2-3. GIS Data provided by the OWRB allowed identification of permits in each model that were located within the OCWP sub-basin boundaries. In each model, a column was added in the Demand Patterns worksheet to identify which sub-basin contained each permit represented in the model.

Table 2-3: Relationship of Spatial Domain of Water Allocation Models and OCWP analyses.

Water Allocation Model	OCWP Basins
Muddy Boggy Model	Muddy Boggy – 1 Muddy Boggy – 2 Clear Boggy

Kiamichi Model	Kiamichi – 1 Kiamichi - 2
Little River Model	Little River – 1 Little River – 2 Little River – 3

2.6 Assigning OCWP Uses to Water Rights Permits within the Model Basins

The use types in the OWRB water allocation model sub-basins did not match one-to-one with the use types in the OCWP report. Table 2-4 shows the water use types used in the water allocation models and the OCWP analyses.

Table 2-4: Water Use Types Used in the Water Allocation Models and OCWP analyses.

Water Allocation Model	OCWP Basins
Municipal & Industrial (M&I) Crop Irrigation (IRR) Wetland Evaporation Other	Municipal & Industrial (MI) Self Supplied Rural Residential (SSRR) Self Supplied Industrial (SSI) Thermoelectric Power (Therm) Livestock (Livestock) Crop Irrigation (IRR) Oil and Gas (OG)

While all of the OWRB water allocation models contained Municipal & Industrial (M&I) and Crop Irrigation (IRR) uses, some of them also included Wetland, Evaporation, and "Other" uses that weren't in the OCWP report. The water allocation models were refined to include the OCWP water use types.

To add the OCWP uses to the existing models, we added demands or reassigned "Other" permit types to Oil and Gas, Livestock, Self Supplied Industrial, Self Supplied Rural Residential and Thermoelectric (as necessary) and added demand points to the models for the use types that were previously not represented in the models. The new demand points were located on the main stem streams in each of the sub-basins within the model. The location of these new demands may affect whether or not there is a shortage to the demand. Locations on the main stem of a stream will reduce the potential for a shortage, while a location on a smaller tributary will increase that potential. In the future, as more information is obtained about these water uses, the models can be further refined by changing the location of these aggregated demands or by disaggregating them to multiple locations within the sub-basins. The Muddy Boggy and the Kiamichi models already had Thermoelectric Power demands in them, but the Little River model had only Municipal & Industrial and Crop Irrigation demands.

OCWP depletions were then allocated on a prorated basis based on the total acre-foot volume allowed for the permit against the total for the other permits in the same sub-basin with the same use type.

2.7 Special Cases in Muddy Boggy Model

Each of the three models required modifications that did not apply to the other models. This section describes the changes that were made to the Muddy Boggy Model.

For a short time after the Muddy Boggy water allocation model was developed, the OWRB deleted from the model water use for permits that had been cancelled. Because this practice introduced errors in the historical scenarios, the OWRB later changed its practice; OWRB requested that the Muddy Boggy model be revised to incorporate the deleted permits prior to incorporation of the OCWP water use scenario. Accordingly, the permits that had been cancelled in the Muddy Boggy model were restored, with historical values used for the historical period up until the cancellation date of the permit and zero values from that point forward.

The Thermoelectric Power uses in the Muddy Boggy are imports of water from another basin and so were represented in the model as a static inflow (Inflow 78). The value of this inflow was estimated as a 38% return flow from thermoelectric demand in the OCWP report (12,040 AFY), spread evenly over the year, entering the model in HUC 111401030302.

The City of Oklahoma City uses three permits to export water from the basin; each of these permits is represented with an M&I use pattern but with a 100% consumption factor to represent the fact that the water is exported from the basin. For the purposes of the model, these exports were assigned to a special OCWP use type designated as “Export”, which was given the M&I use pattern but not counted in the total amount of water used for M&I in the basin.

The model did not have a Self Supplied Rural Residential use type. To represent this use type, we added an aggregated permit to the model in each of the three sub-basins to deplete the river by the amount of surface water consumed by these uses in the OCWP study. These new permits were added to the model in the following locations:

Table 2-5: Table of Aggregate SSRR Depletions added to Muddy Boggy Model.

OCWP Sub Basin	HUC Location	Model Node	Model Demand ID
Muddy Boggy – 1	111401030705	13	133
Muddy Boggy – 2	111401030601	36	132
Clear Boggy	111401040207	225	131

The model did not have an Oil and Gas use type or any permits assigned to that type of use. We added aggregate permits to the model in the Clear Boggy and Muddy Boggy - 2 sub-basins to simulate the depletion assigned to these uses. These new permits were added to the model in the following locations:

Table 2-6: Table of Aggregate Oil and Gas depletions added to Muddy Boggy model.

OCWP Sub Basin	HUC Location	Model Node	Model Demand ID
Muddy Boggy – 2	111401030505	35	130
Clear Boggy	111401040205	235	129

While the original Muddy Boggy Model did not have any uses assigned to Livestock, there were several permits whose purpose was described in the model Demand Patterns worksheet as “Agriculture” as opposed to “Irrigation” and in the original model they were assigned an “Other” use pattern which is the same pattern used in the OCWP study for Livestock. A “livestock” use type was created in the model and the water use for these permits was changed to that use type. These depletions retained the priority assigned to them in the historical model runs based on their permit date.

Table 2-7: Table of permits changed from Irrigation to Livestock use types.

OCWP Sub Basin	Permit Number	Owner	Model Demand ID
Clear Boggy	19690309	Dunn’s Fish Farm of Arkansas, Inc.	116
Clear Boggy	19770158	Dunn’s Fish Farm of Arkansas, Inc.	115
Clear Boggy	19880013	Neal, Jim	102
Clear Boggy	19940006	DHM Enterprises, Inc.	85
Muddy Boggy – 2	19930040	Nix, Jimmy L & Rita D	56
Muddy Boggy – 2	19940016	G H B Farms, Inc.	35
Muddy Boggy – 2	19940033	Tyson Foods, Inc.	55
Muddy Boggy – 2	19940048	Harden, Delbert A	52
Muddy Boggy – 2	19940051	Howard, Jamie W and Earlene	57
Muddy Boggy – 2	19940053	Tyson Foods, Inc.	45
Muddy Boggy – 2	19950044	King, Will Alan	51
Muddy Boggy – 1	20080002F	New Aggregated Livestock Permit	139

2.8 Special Cases in the Kiamichi Model

The model had no permits with use types corresponding to Livestock, Oil & Gas, Self Supplied Rural Residential, or Self Supplied Industrial. Aggregated permits for these use types were added to the model in both of the sub-basins. All of the depletions of these uses were assigned to a point at the bottom of each sub-basin in the model. These depletions were assigned the highest priority.

Table 2-8: Table of aggregate depletions added to Kiamichi Model.

OCWP Sub Basin	OCWP Use Type	HUC Location	Model Node	Model Demand ID
Kiamichi – 1	Livestock	111401050803	193	46
Kiamichi – 1	Oil & Gas	111401050803	193	47
Kiamichi – 1	Self Supplied Rural Residential	111401050803	189	48
Kiamichi – 1	Self Supplied Industrial	111401050803	189	49
Kiamichi – 2	Livestock	111401050402	83	50
Kiamichi – 2	Oil & Gas	111401050402	83	51
Kiamichi – 2	Self Supplied Rural Residential	111401050402	82	52
Kiamichi – 2	Self Supplied Industrial	111401050402	82	53

2.9 Special Cases in the Little River Model

The Little River Basin Model had no permits with a use type of Thermoelectric Power. Information from the OCWP indicated that the two Weyerhaeuser water permits in the Little River represented Thermoelectric Power uses, so their use types were changed from Municipal and Industrial to Thermoelectric Power and the corresponding OCWP demands were assigned to those permits.

The Little River Basin water allocation model had no permits with use types corresponding to Self Supplied Industrial, Self Supplied Rural Residential, Livestock or Oil and Gas. Aggregated permits for these use types were added to the model in each of the sub-basins. All of the depletions for these uses were assigned to a point at the bottom of the sub-basin in the model. These depletions were assigned the highest priority.

The Self Supplied Industrial demands from the OCWP report indicated a total surface water supplied demand for 2007 of 1,743 AFY, but the historical use data developed for the historical water use scenario in the OWRB water allocation model of the Little River basin indicated there was an International Paper Company permit (number 19670560) that used 33,605 AFY in 2007. In order to maintain consistency between the OWRB historical scenario and the OCWP 2007 scenario, the SSI demands in the latter were increased to

33,605 AFY. The OCWP adjustments were applied to that demand in order to develop estimates of SSI water use for 2010, 2030 and 2060. A water demand was inserted into the Little River–2 model network to represent other SSI uses, but this demand was set to zero when it was determined that all the SSI uses would be represented at permit 19670560.

Table 2-9: Table of aggregate depletions added to the Little River Model.

OCWP Sub Basin	OCWP Use Type	HUC Location	Model Node	Model Demand ID
Little River – 1	Livestock	11401090102	168	32
Little River – 1	Oil & Gas	11401090102	168	33
Little River – 1	Self Supplied Rural Residential	11401090102	168	35
Little River – 1	Self Supplied Industrial	11401090102	168	34
Little River – 2	Livestock	111401070404	158	36
Little River – 2	Oil & Gas	111401070404	158	37
Little River – 2	Self Supplied Rural Residential	111401070404	158	39
Little River – 2	Self Supplied Industrial	111401070404	158	38
Little River – 3	Livestock	111401080307	54	40
Little River – 3	Oil & Gas	111401080307	54	41
Little River – 3	Self Supplied Rural Residential	111401080307	54	43
Little River – 3	Self Supplied Industrial	111401080307	54	42

3.0 MUDDY BOGGY MODEL RESULTS

The Muddy Boggy Model had the largest depletions and the most water right permits of the three basins modeled. The table below summarizes the total annual depletions calculated by the model, the total depletions in the basin over the model run period, and the total volume of shortages to all of the permits. The model run period included 59 years.

Table 3-1: Muddy Boggy Model Annual Depletion and Shortages.

OCWP Use Scenario	Annual Depletion (AFY)	Total Basin Depletions 1950-2008 (AF)	Total Basin Shortages 1950-2008 (AF)	Permit-Months with less than Full Supply	Percentage of Permit-Months with less than Full Supply
2007	85,198	5,026,682	17,903	875	1.25%
2010	88,531	5,223,329	20,269	900	1.28%
2030	98,078	5,786,602	24,684	927	1.32%
2060	100,492	5,929,028	36,345	909	1.28%

From this table you can see the effects of the increasing demands on the river system. The model has 99 permits so a 59 year model run has 70,092 permit-months (59*12*99). In the 2007 scenario, 875 short permit-months represent just over 1% of the permit-months. Fifty-eight of the permits in the model accounted for all of the shortages in the 2060 scenario, while the other 41 received their full supply in all scenarios.

3.1 Changes in Depletions

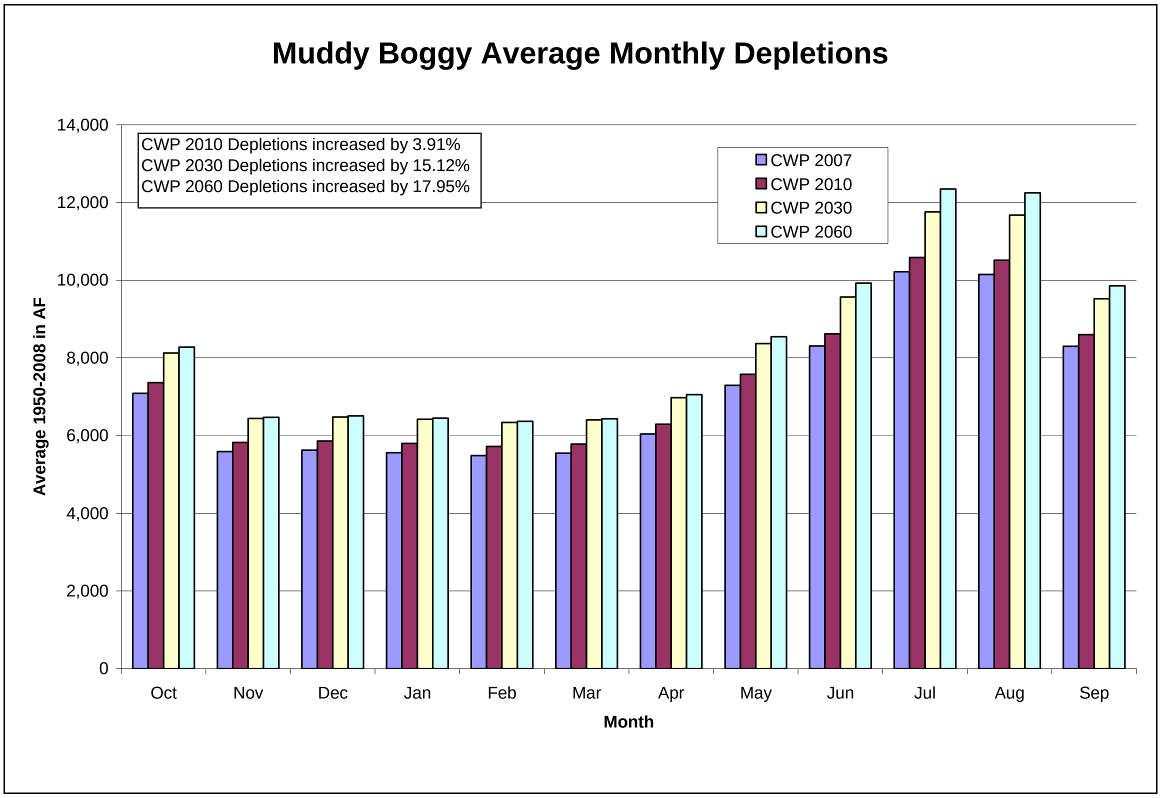
The depletions increased at each OCWP demand level. The table below shows the increases in depletion in the 2010, 2030 and 2060 scenarios.

Table 3-2: Depletion Increases from OCWP 2007 levels.

OCWP Use Scenario	Annual Depletion (AFY)	Percentage Increase
2007	85,198	
2010	88,531	3.91%
2030	98,078	15.12%
2060	100,492	17.95%

The increases were most significant in the summer months and relatively flat in the winter months. Figure 3-1 illustrates the distribution of the increases in depletion.

Figure 3-1: Graph of Average Monthly Depletions for Muddy Boggy.



3.2 Shortages to Depletions

Figure 3-2 illustrates the average shortages to the all of the depletions in the model for the three OCWP demand levels. The decrease in shortages during the late summer months between the 2030 and 2060 runs is due to the reduction in Oil and Gas uses in the 2060 scenario. The increase in shortages in the 2060 model run in the winter months is due to the City of Oklahoma City permit draining Atoka Reservoir. Table 6-1 in Appendix A, shows which permits had shortages and the magnitude of those shortages in each of the OCWP scenarios.

Figure 3-2: Average Shortages to All Depletions in the Muddy Boggy Model.

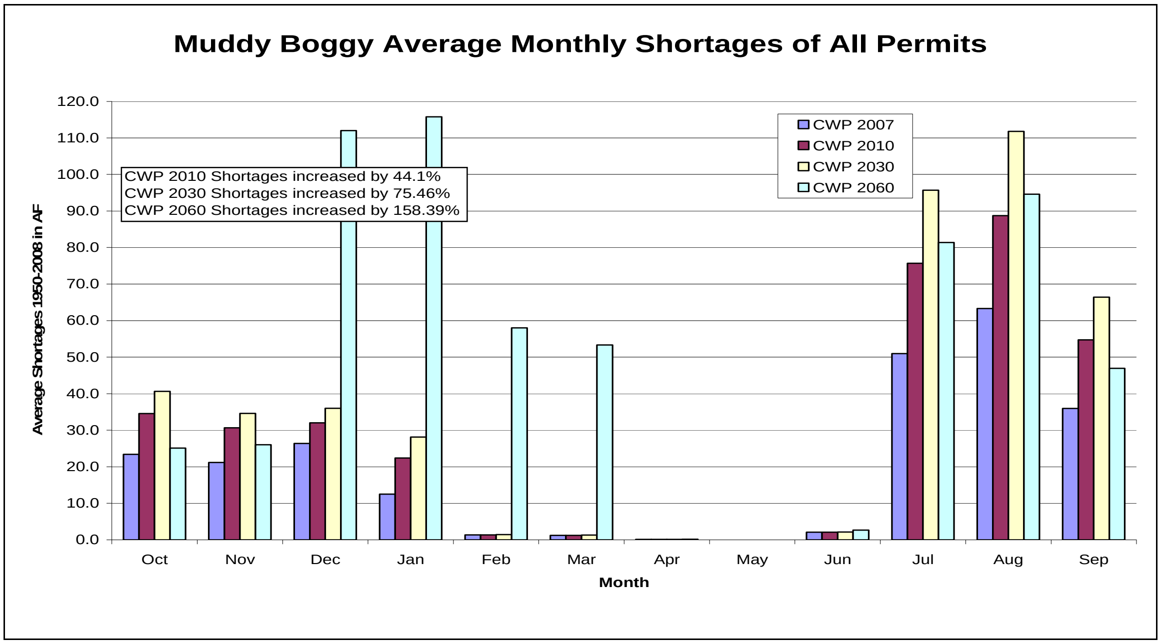
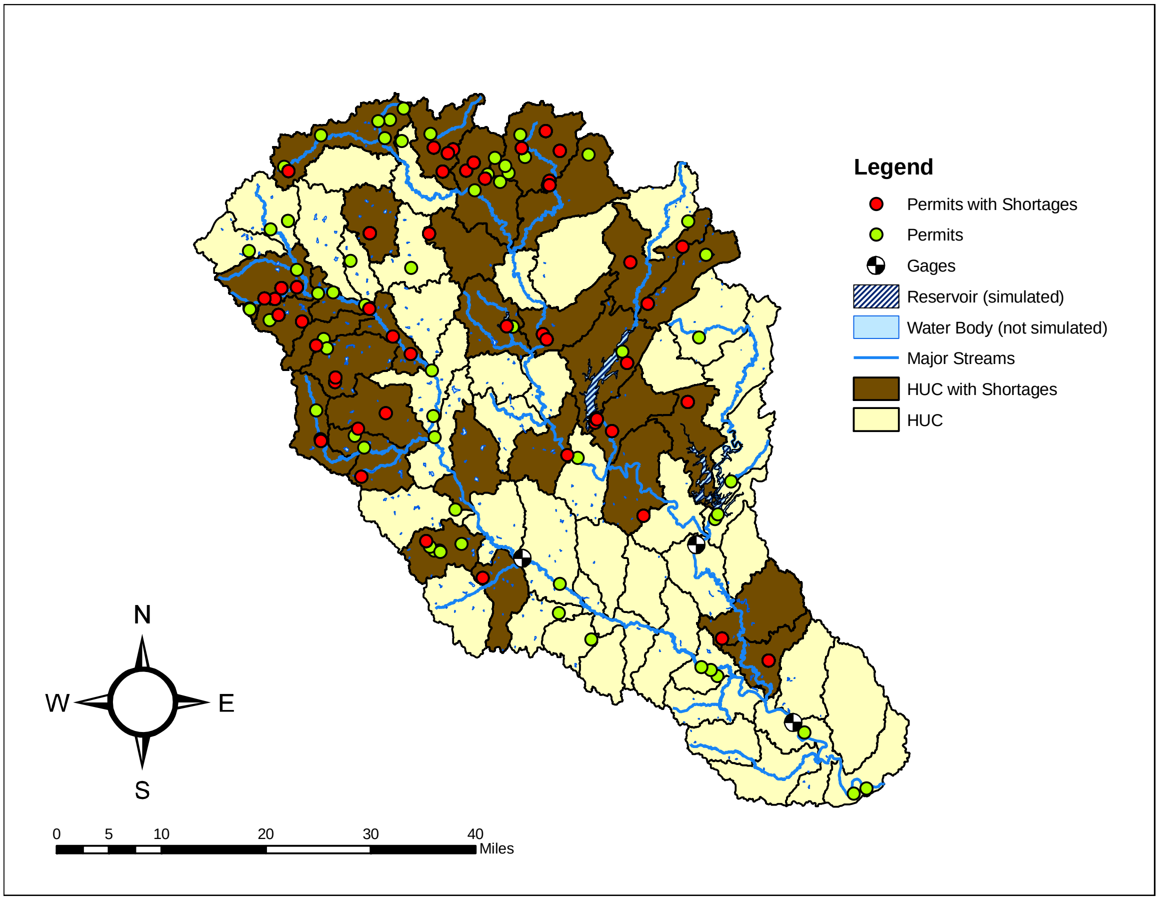


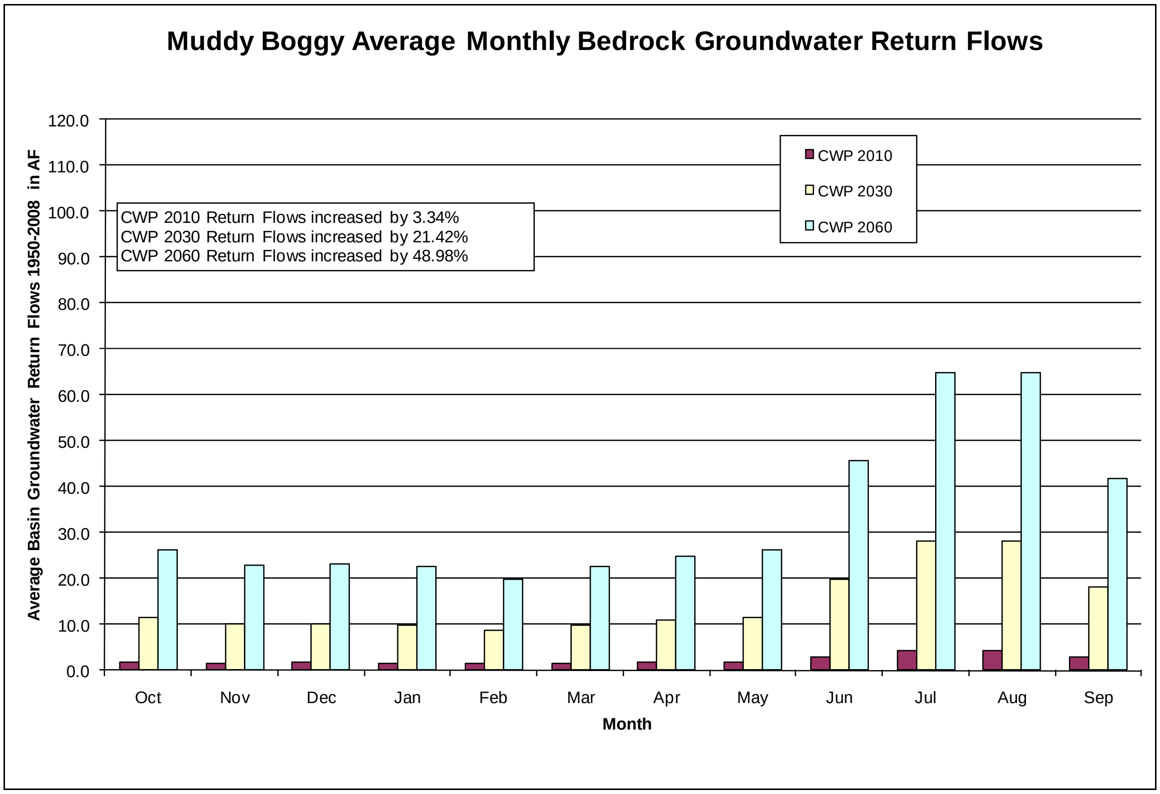
Figure 3-3 illustrates the locations at which shortages occurred in any of the OCWP projected future water use scenarios.

Figure 3-3: Location of Shortages in the Muddy Boggy Model.



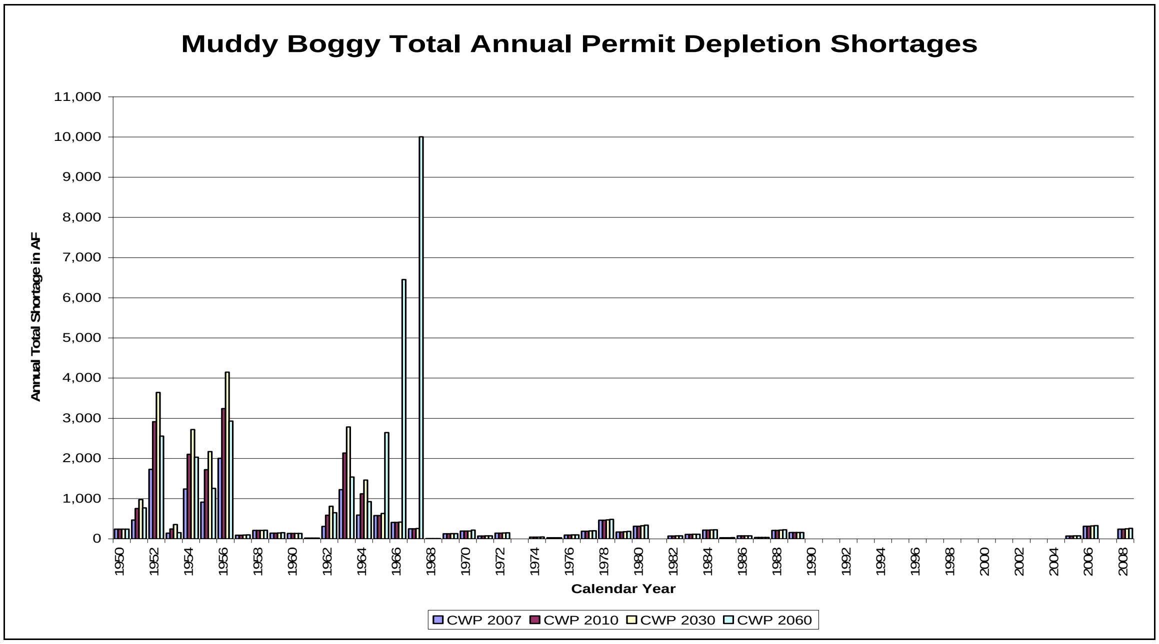
The some of the shortages estimated by the model in the Muddy Boggy basin may be somewhat reduced due to return flows from increased use of bedrock groundwater in the 2010, 2030 and 2060 scenarios. Figure 3-4 illustrates the increases in return flows in the basin due to increased bedrock groundwater use. Because the locations of these return flows are not precisely known it is currently not possible to determine which shortages in the basin would be reduced.

Figure 3-4: Bedrock Groundwater Return Flows in the Muddy Boggy Model.



The figure 3-5 illustrates the years in which a shortage was found in the OCWP scenarios. The large spike in the 2060 scenario corresponds to a year in which Atoka reservoir was emptied and the Oklahoma City permit was unable to export water from the basin.

Figure 3-5: Annual Shortages in the Muddy Boggy Model.



3.3 Changes in USGS Gage Flows

Figures 3-6 and 3-7 show the average change in gaged flows and the annual changes in gaged flows, respectively.

Figure 3-6: Average Monthly Volume Passing USGS Gage 07335300

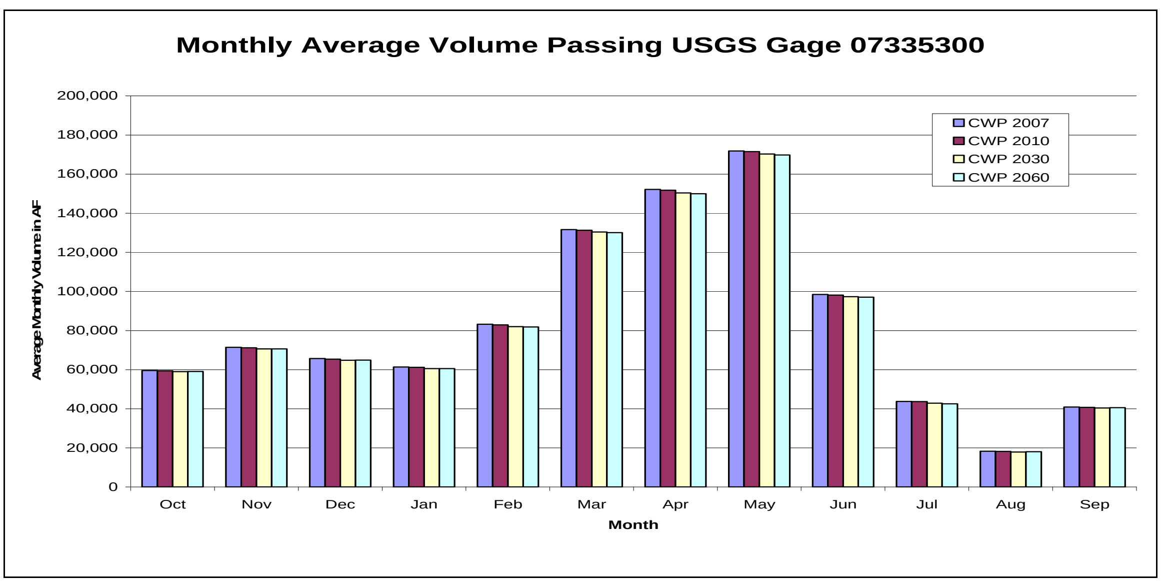


Figure 3-7: Annual Volumes Passing USGS Gage 07335300

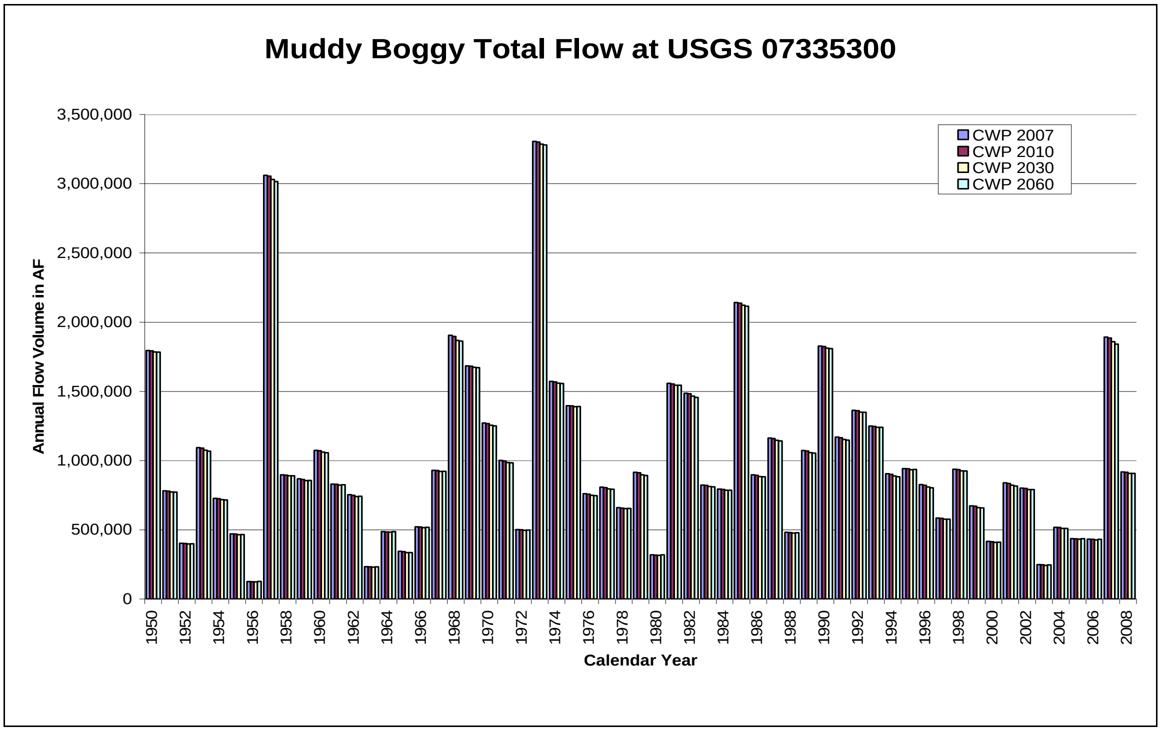
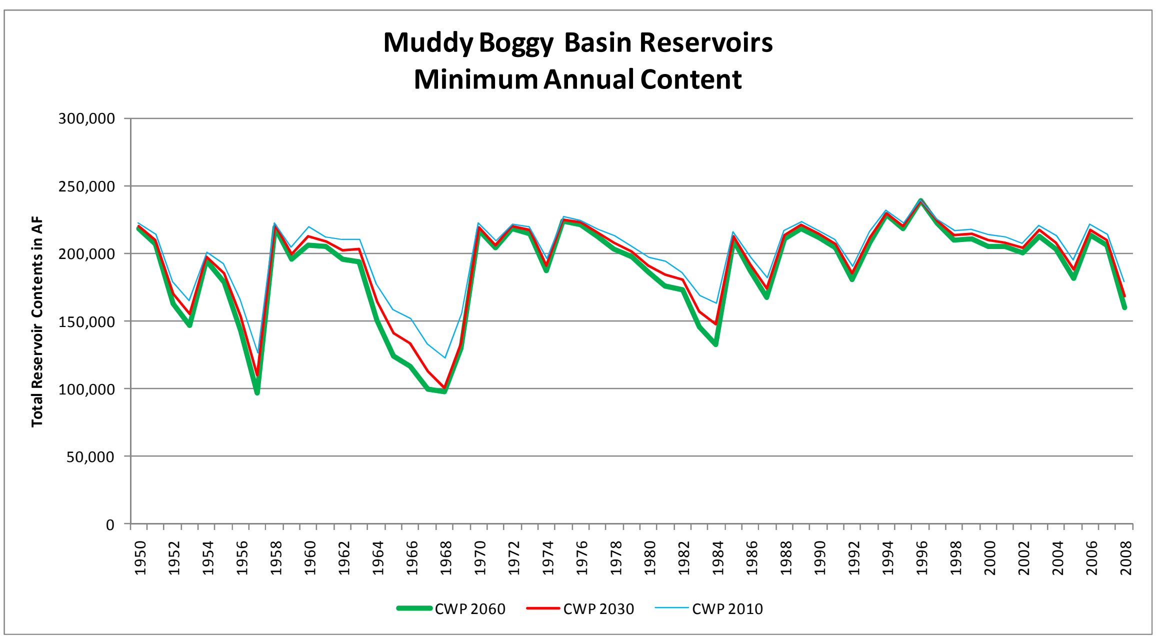


Figure 3-8 shows the impact of projected future increases in water use on the minimum basin reservoir storage throughout the study period.

Figure 3-8: Minimum Reservoir Contents in the Muddy Boggy Model.



4.0 KIAMICHI MODEL RESULTS

The table below summarizes the total annual depletions calculated by the model, the total depletions in the basin over the model run period, and the total volume of shortages to all of the permits. The model run period included 59 years.

Table 4-1: Kiamichi Model Annual Depletion and Shortages.

OCWP Use Scenario	Annual Depletion (AFY)	Total Basin Depletions 1950-2007 (AF)	Total Basin Shortages 1950-2007 (AF)	Permit-Months with less than Full Supply	Percentage of Permit-Months with less than Full Supply
2007	8,184	474,672	73	10	0.028%
2010	8,398	487,084	74	10	0.028%
2030	10,007	580,406	132	14	0.039%
2060	12,994	750,752	251	17	0.048%

This table shows the effects of the increasing demands on the river system. The model has 51 permits so a 58 year model run has 35,496 permit-months (58*12*51). Nine permit-months of shortage represents much less than 1% of all permit-months in the model. All of the shortages occur in just 2 of the 51 permits.

4.1 Changes in Depletion

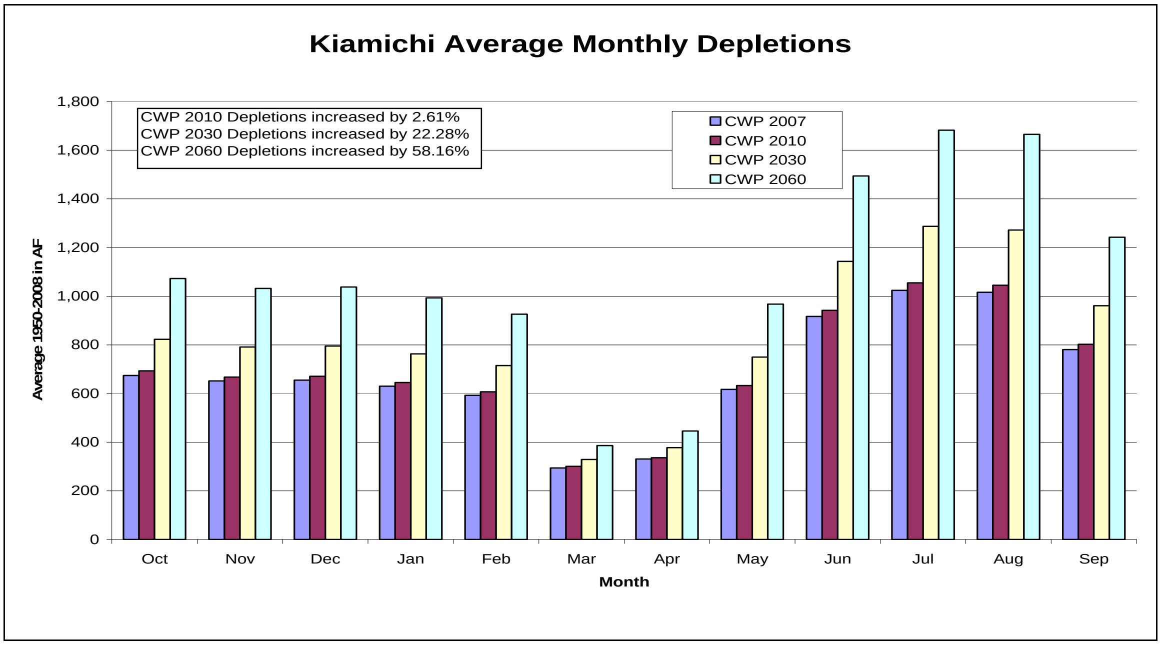
The depletions increased at each OCWP demand level. The table below shows the increases in depletion in the 2010, 2030 and 2060 scenarios.

Table 4-2: Depletion Increases from OCWP 2007 levels.

OCWP Use Scenario	Annual Depletion (AFY)	Percentage Increase
2007	8,184	
2010	8,398	2.61%
2030	10,007	22.28%
2060	12,944	58.16%

Figure 4-1 below illustrates the monthly distribution of depletions within the Kiamichi basin. The distribution reflects the larger amount of Crop Irrigation uses in the basin.

Figure 4-1: Graph of Average Monthly Depletions.



4.2 Shortages to Depletion

Figure 4-2 below illustrates the average shortages to the all of the depletions in the model for the three OCWP demand levels. The magnitude of these shortages is very small, averaging at most 3 AF/Month in the 2060 scenario. Table 6-2 in Appendix A shows which permits had shortages and the size of those shortages in the OCWP scenarios.

Figure 4-2: Average Monthly Shortages to Depletions.

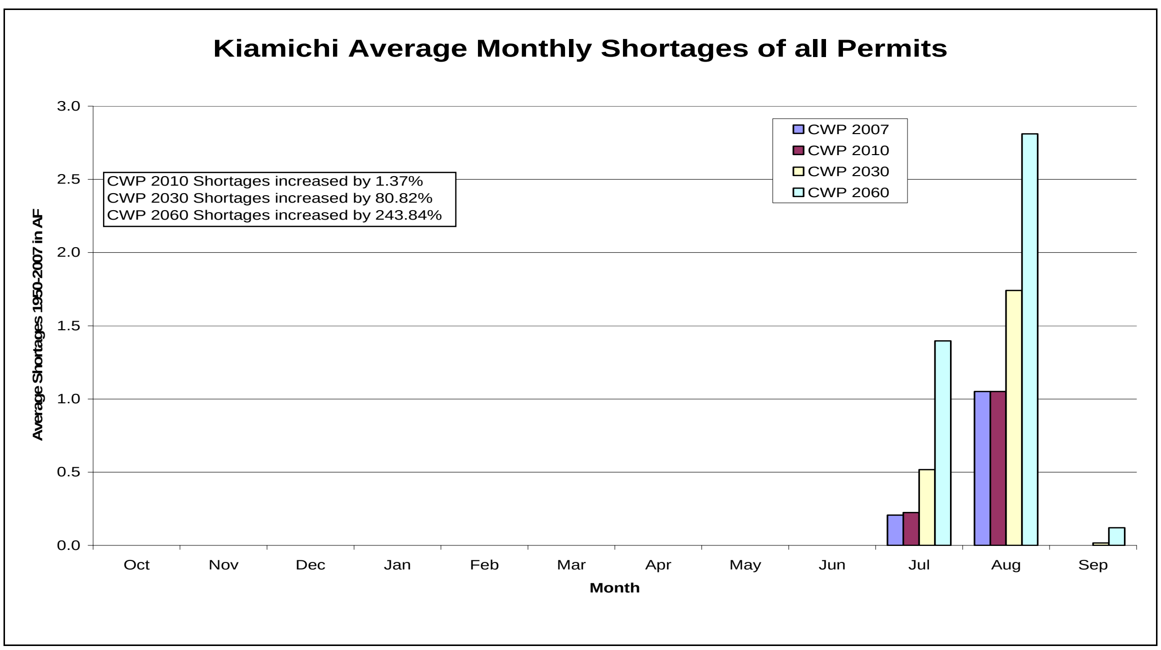


Figure 4-3 below illustrates the years in which a shortage was found in the OCWP scenarios. The graph indicates shortages were only found in the dry period in the 1950s and were made more severe by the increased depletions of the 2010, 2030 and 2060 scenarios.

Figure 4-3: Annual Total Depletion Shortages.

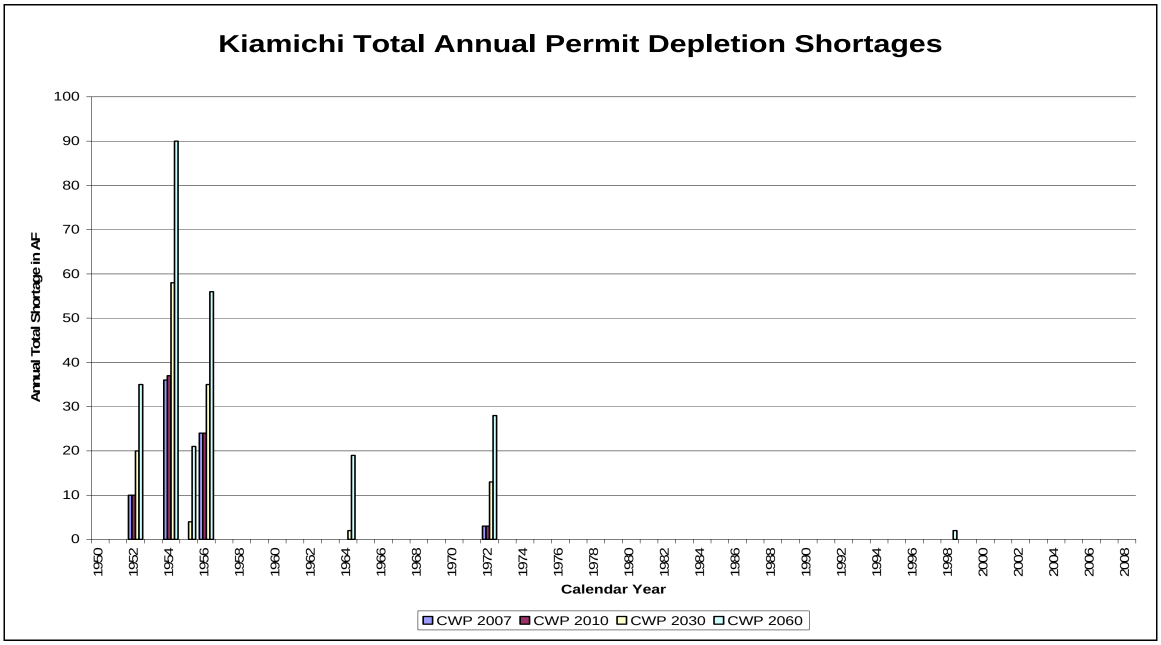
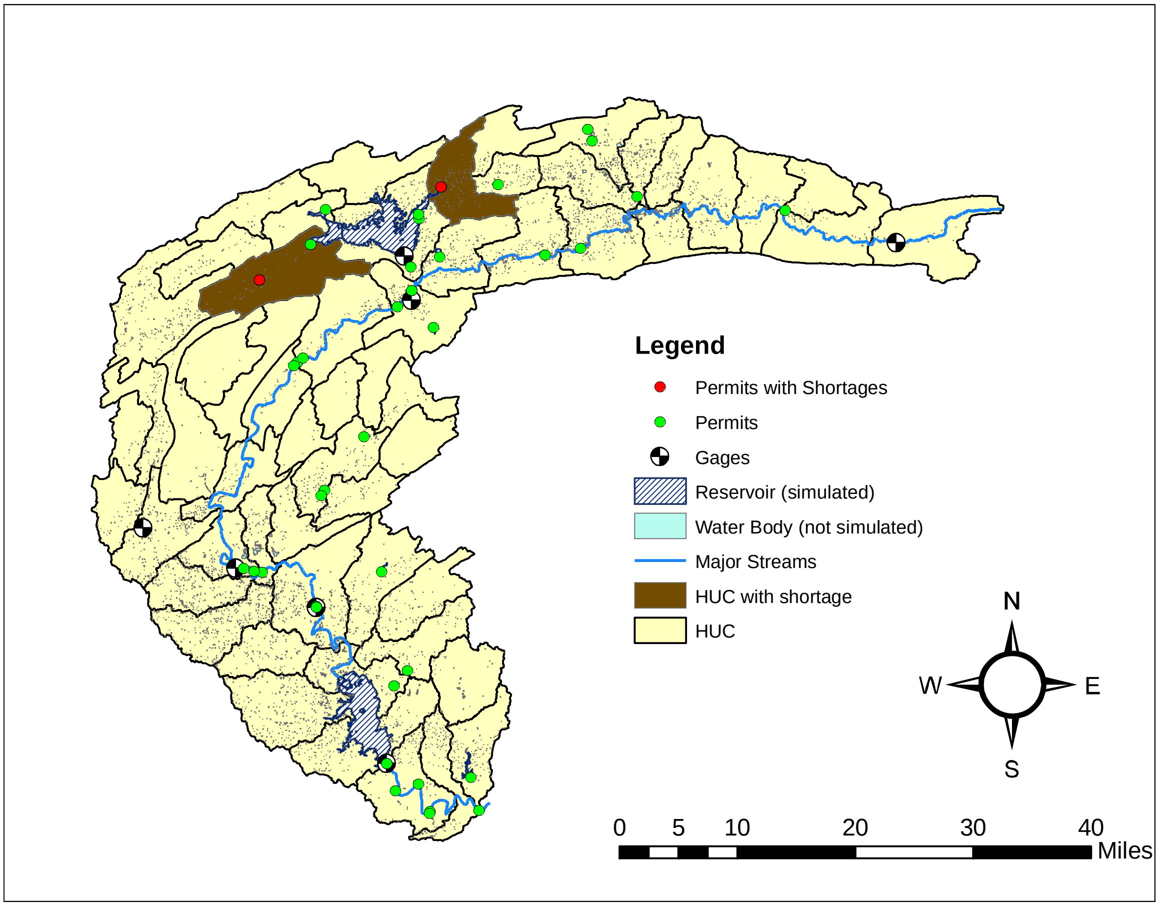


Figure 4-4, below, illustrates the locations at which shortages occurred in any of the OCWP projected future water use scenarios.

Figure 4-4: Locations of Shortages in the Kiamichi River.



4.3 Changes in USGS Gage Flows

As shown in Figures 4-5 and 4-6 below, the increased depletions have little effect on the average flow passing the USGS Gage 07336600 Hugo Lake near Hugo, OK which is at the bottom of the Kiamichi model.

Figure 4-5: Average Monthly Volume passing USGS Gage 07336600

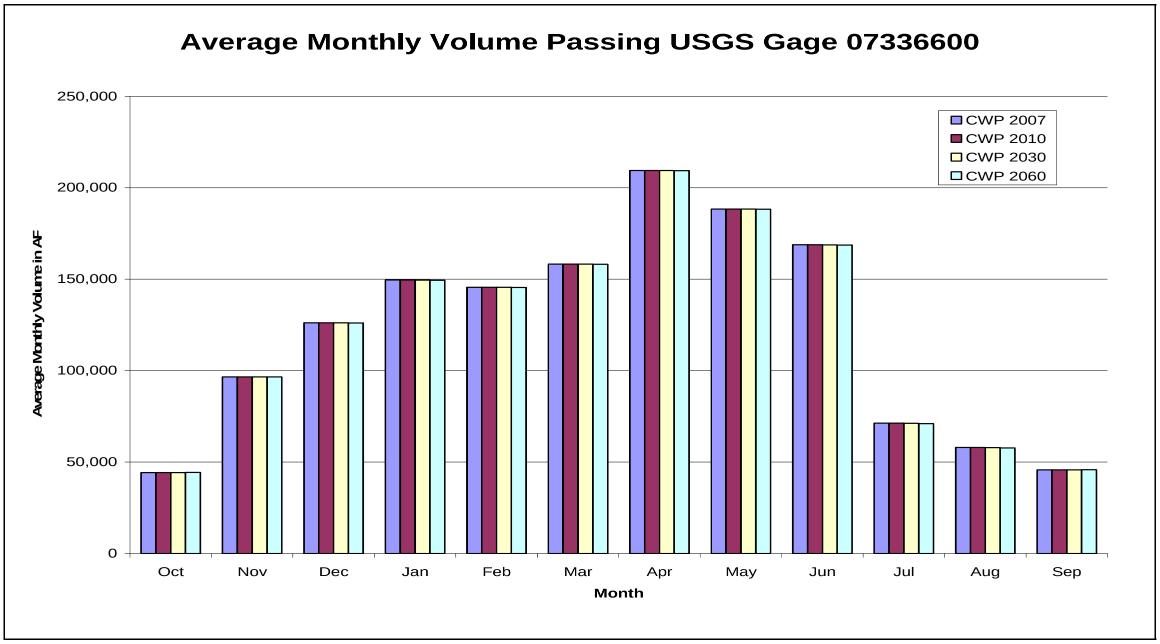
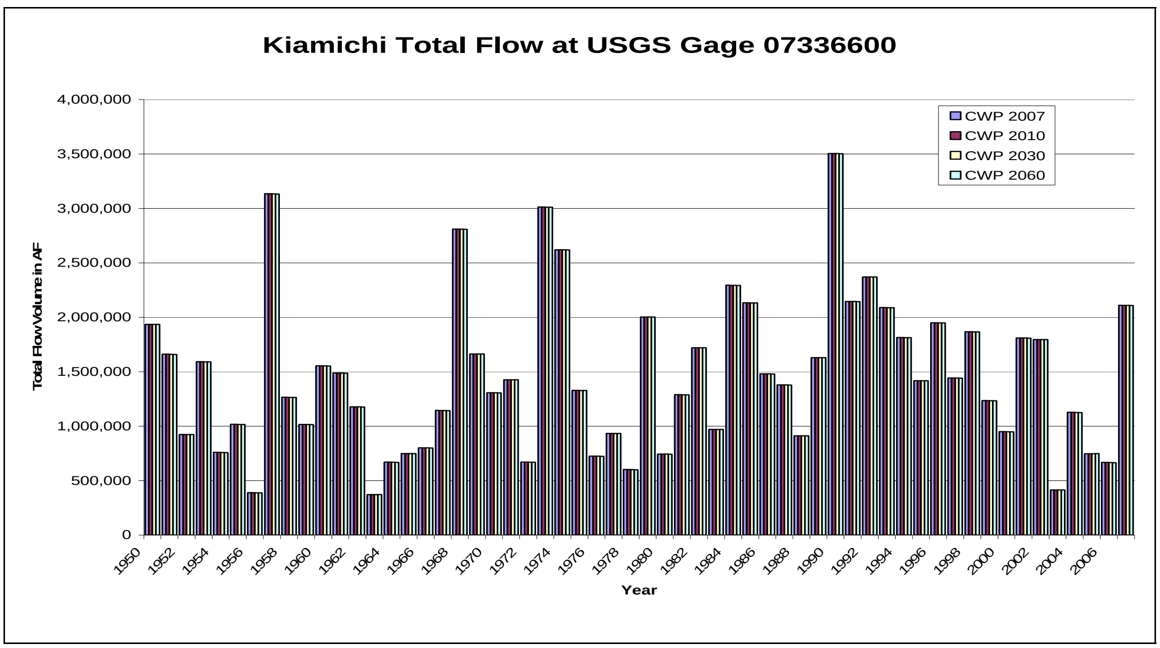


Figure 4-6: Annual Volume passing USGS Gage 07336600



The increases in water use projected by the OCWP had no significant effect on the minimum reservoir contents in the Kiamichi River system.

5.0 LITTLE RIVER MODEL RESULTS

Like the Kiamichi River, the projected increases in water use by the OCWP appear to cause only very limited shortages in the Little River basin. The table below summarizes the total annual depletions calculated by the model, the total depletions in the basin over the model run period and the total volume of shortages to all of the permits. The model has 42 permits so the 59 year model run has 29,736 permit-months (59*12*42). Ten permit-months of shortage represents much less than 1% of all permit-months in the model. All of the shortages occur in just 2 of the 42 permits.

Table 5-1: Little River Model Annual Depletion and Shortages.

OCWP Year	Annual Depletion (AFY)	Total Basin Depletions 1950-2008 (AFY)	Total Basin Shortages 1950-2008 (AFY)	Permit-Months with less than Full Supply	Percentage of Permit-Months with less than Full Supply
2007	21,562	1,272,158	43	11	0.037%
2010	21,633	1,276,347	43	11	0.037%
2030	22,292	1,315,228	57	11	0.037%
2060	23,386	1,379,774	102	13	0.044%

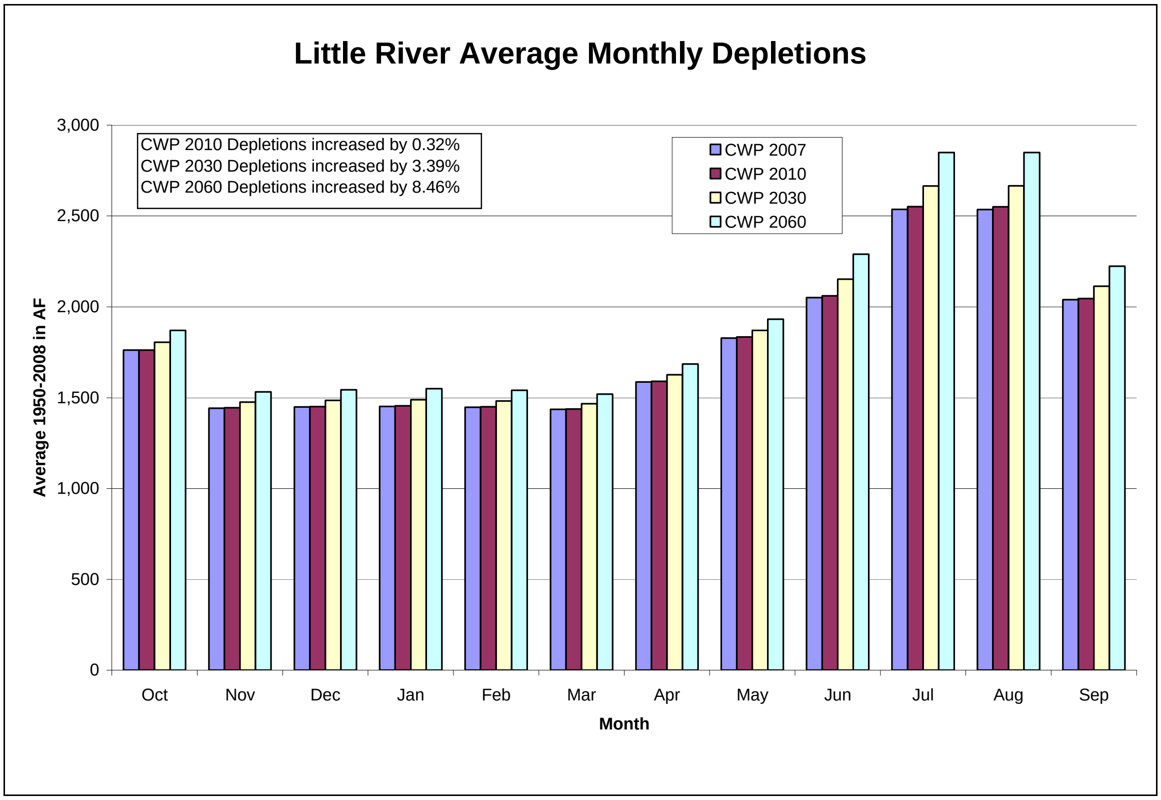
5.1 Changes in Depletion

The depletions increased at each OCWP demand level. The table below shows the increases in depletion in the 2010, 2030 and 2060 scenarios.

Table 5-2: Depletion Increases from OCWP 2007 levels.

OCWP Year	Total Annual Depletion (AFY)	Percentage Increase
2007	21,562	
2010	21,633	0.32%
2030	22,292	3.39%
2060	23,386	8.46%

Figure 5-1: Average Monthly Depletions



5.2 Shortages to Depletions

The graph below (Figure 5-2) illustrates the average shortages to the all of the depletions in the model for the three OCWP demand levels. The magnitude of these shortages is very small, with the largest monthly shortages averaging just over 3 AF in the 2060 scenario. Table 6-3 in Appendix A shows which permits had shortages and the size of those shortages for each OCWP scenarios.

Figure 5-2: Average Monthly Shortages to Depletions

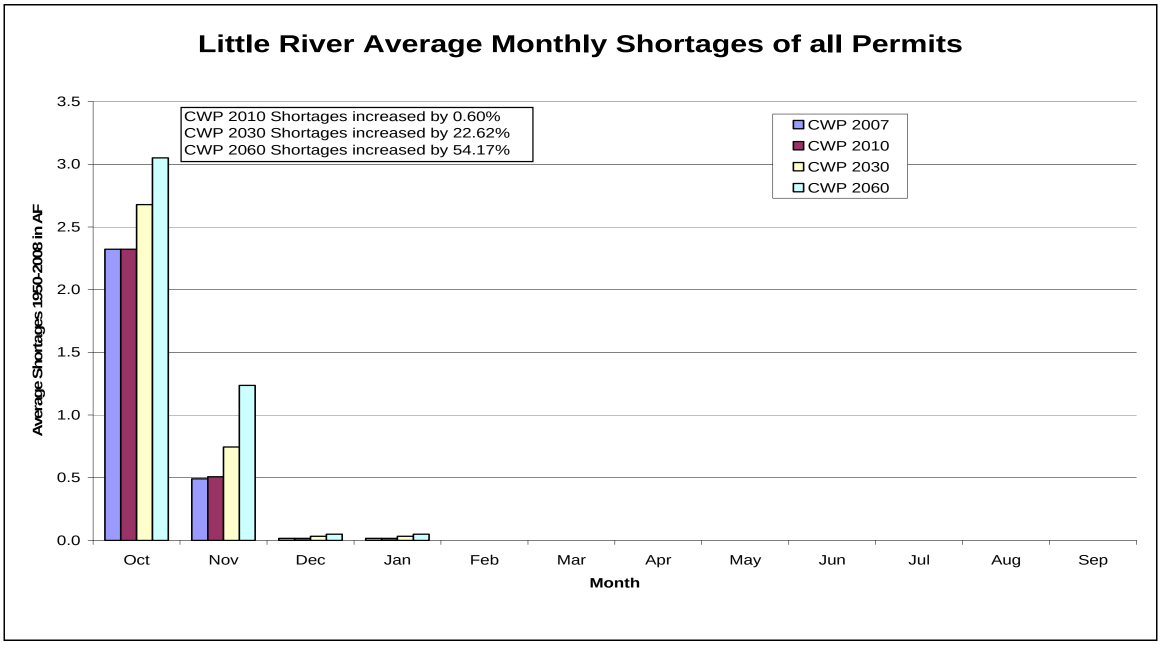


Figure 5-3: Annual Total Depletion Shortages

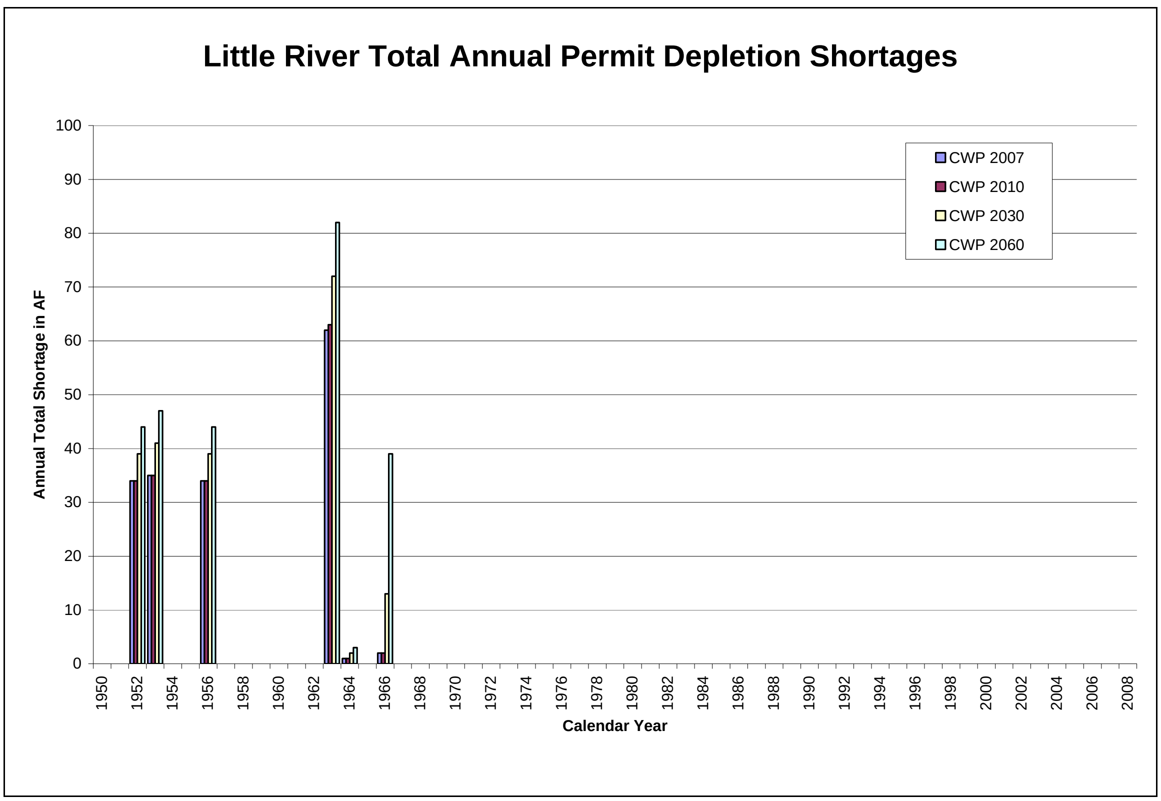
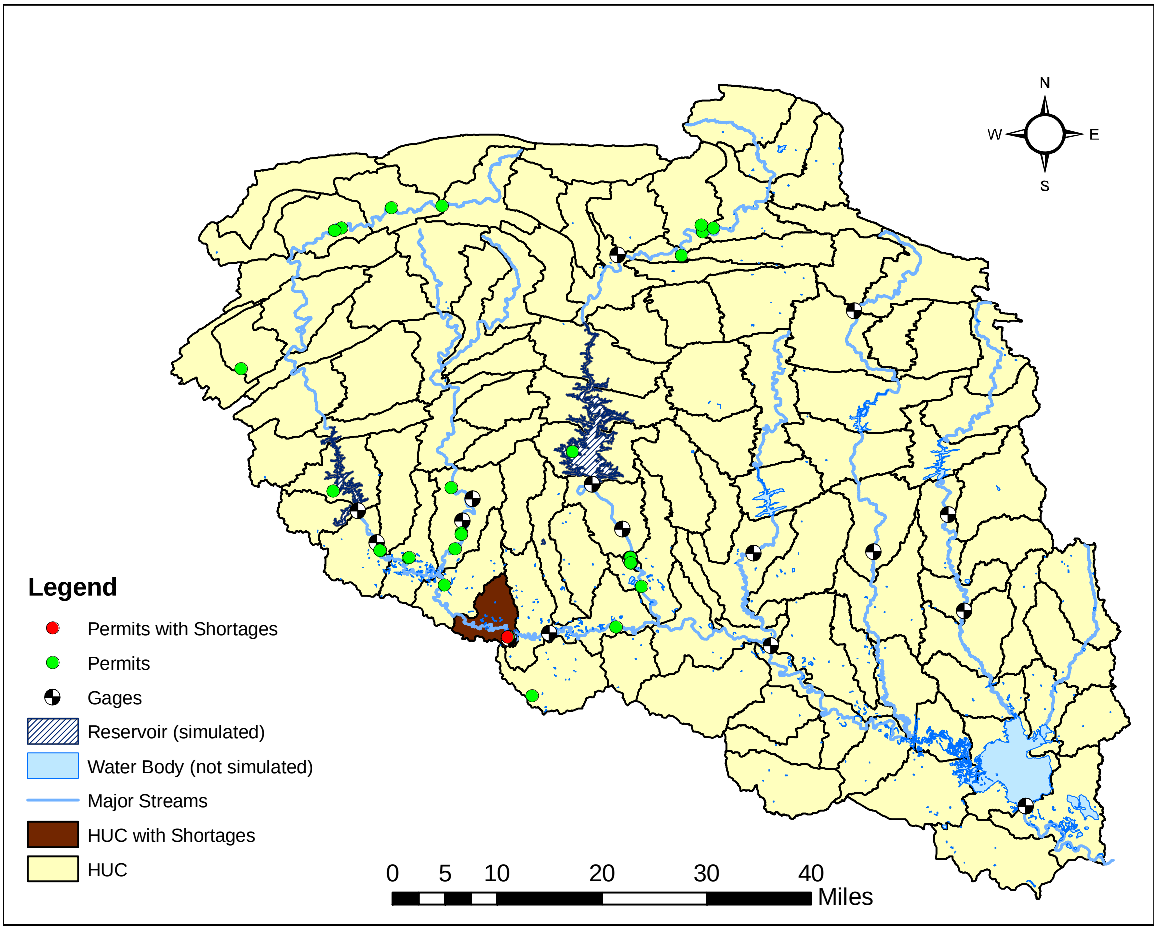


Figure 5-4 illustrates the locations at which shortages occurred in any of the OCWP projected future water use scenarios.

Figure 5-4: Locations of Shortages in the Little River.



5.3 Changes in USGS Gage Flows

As shown in the chart below, the increased depletions have little effect on the average flow passing the USGS Gage 07340000 Little River near Horatio, AR which is at the bottom of the Little River model. With annual flows occasionally exceeding 4 million acre-feet in a year, the increased depletions are difficult to detect. The average annual flow passing the gage is 2.7 million acre-feet.

Figure 5-5: Average Monthly Volume passing USGS Gage 07340000

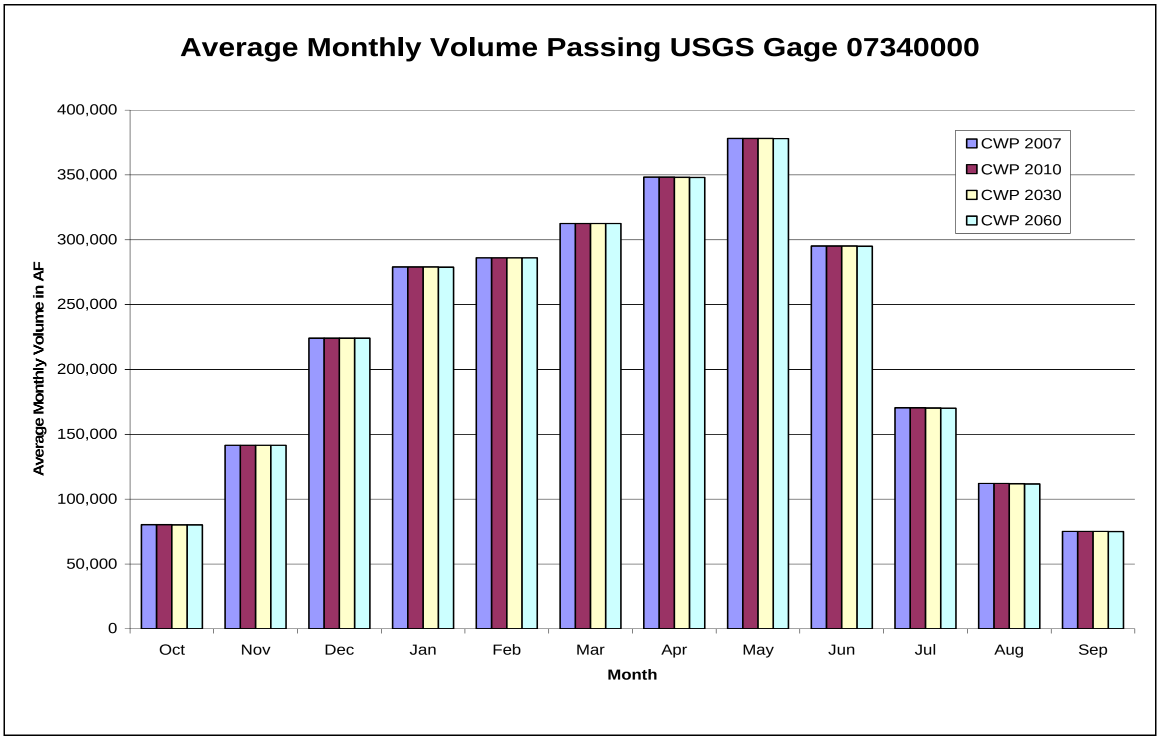
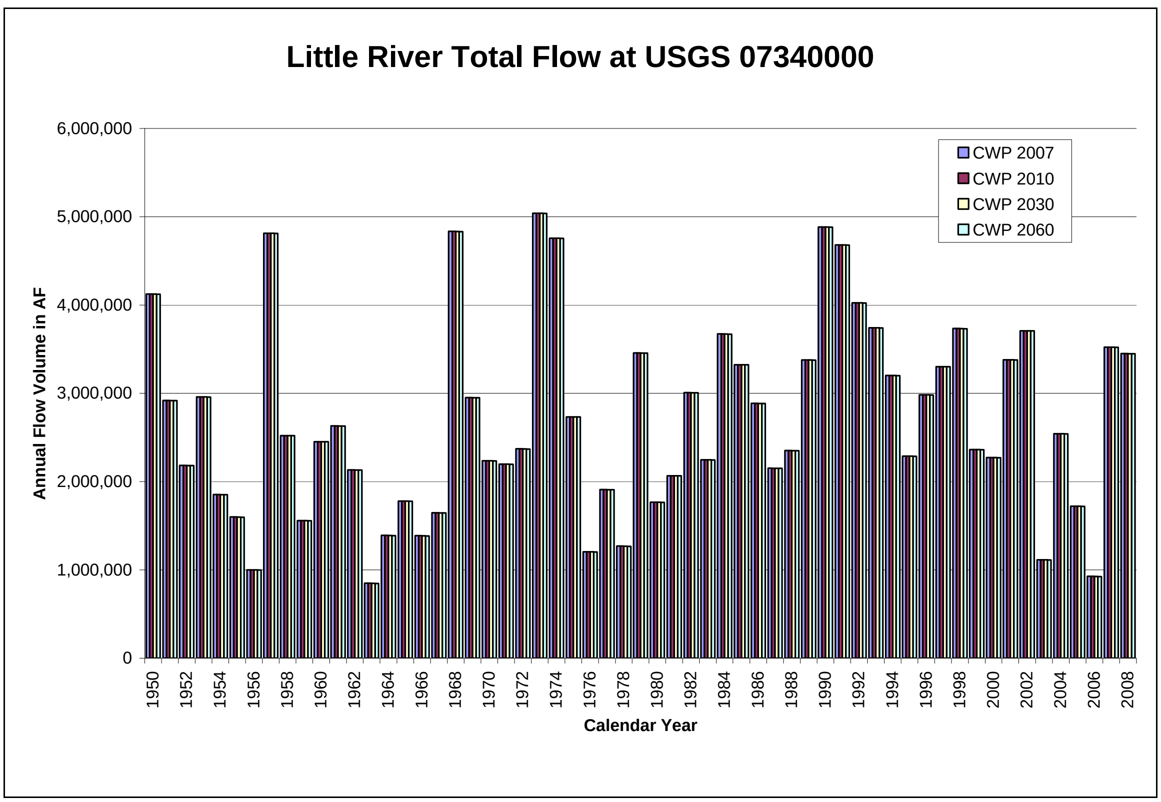


Figure 5-6: Annual Volume passing USGS Gage 07340000



The increases in water use projected by the OCWP had no significant effect on the minimum reservoir contents in the Little River system.

6.0 APPENDIX A

Table 6-1: List of Muddy Boggy Permits with Shortages

Table 6-2: List of Kiamichi Permits with Shortages

Table 6-3: List of Little River Permits with Shortages

Table 6-1: List of Muddy Boggy Permits with Shortages.

			OCWP 2007		OCWP 2010		OCWP 2030		OCWP 2060	
OCWP Sub Basin	Permit Number	Entity Name	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage
Export Muddy Boggy - 2	19800048	Oklahoma City, City of	0	0	0	0	0	0	15,696	7
Muddy Boggy - 1	19980049	BC Wetlands LTD	3,926	72	3,926	72	3,926	72	3,926	72
Clear Boggy	20020004	Reinauer, Robert M and Susan E	2,493	78	2,493	78	2,495	78	2,495	78
Muddy Boggy - 2	20000030	Welch, J M & Shelby	876	14	939	14	1,508	15	2,050	14
Clear Boggy	19770158	Dunn's Fish Farm of Arkansas Inc	1,787	97	1,787	97	1,885	98	1,984	99
Export Muddy Boggy - 2	19540613	Oklahoma City, City of	0	0	0	0	0	0	1,877	4
Clear Boggy	19960059_A	Stinchcomb, Roger & Cindy	937	68	937	68	952	69	967	70
Muddy Boggy - 2	19990017	Edgemont Beef	513	14	556	14	855	14	918	12
Clear Boggy	19880013	Neal, Jim	722	52	724	52	780	52	894	60
Muddy Boggy - 2	19950009	Tipton, Charles & Conita	268	15	287	15	460	17	846	22
Muddy Boggy - 2	19940014	Wilson, Gerald Clifford	289	14	313	14	467	15	708	15
Muddy Boggy - 2	19940033	Tyson Foods Inc	643	25	676	25	676	25	672	26
Muddy Boggy - 2	19940016	G H B Farms, Inc	411	24	456	24	456	24	370	24
Muddy Boggy - 2	19850006	OSU Vegetable Research Station	110	12	122	12	211	13	349	14
Muddy Boggy - 2	19940053	Tyson Foods Inc	253	22	289	25	300	25	296	24
Muddy Boggy - 2	19940051	Howard, Jamie W and Earlene	245	29	245	29	245	29	252	30
Muddy Boggy - 2	20000010	Cedar Valley Nursery Inc	115	14	120	14	184	15	242	13
Muddy Boggy - 2	19820074	Clayton, Rick & Kathy	120	14	130	14	192	14	198	13
Muddy Boggy - 2	19950044	King, Will Alan	198	22	216	24	216	24	187	21
Clear Boggy	19770126	Cannon, Lilly	119	17	119	17	119	17	119	17
Muddy Boggy - 2	19800078	Coalgate Public Works Authority	124	21	137	24	171	24	114	19
Muddy Boggy - 2	19770004	Emerson, Jack G	53	14	58	14	82	14	113	13
Muddy Boggy - 2	20080001	WACCAW Development	90	22	99	24	119	25	108	17
Muddy Boggy - 2	19940048	Harden, Delbert A	126	21	144	24	144	24	106	20
Muddy Boggy - 2	20010001	W-7 Swine Farms Inc	46	15	52	15	67	15	98	15
Muddy Boggy - 2	19660319	Tipton, Charles & Conita	77	14	82	14	120	14	96	12
Muddy Boggy - 2	20020009	Howell Family Trust	13	4	13	4	42	9	88	11
Clear Boggy	20020054	Wall, Bobby D & Debbie	83	20	85	20	85	20	85	20
Muddy Boggy - 1	19990003	Webb, W S Jr & Mary Frances	51	11	51	11	64	13	74	14
Muddy Boggy - 2	19640395	Wildlife Conservation, Dept of	50	13	50	13	50	13	50	13
Clear Boggy	19690309	Dunn's Fish Farm of Arkansas Inc	45	11	47	11	49	11	47	11
Muddy Boggy - 2	19690369	Oklahoma Gas & Electric Company	0	0	0	0	0	0	40	4
Muddy Boggy - 2	19930040	Nix, Jimmy L & Rita D	84	21	96	24	96	24	39	13
Muddy Boggy - 2	19940025	Hughes Co Rural Water District #2	21	21	24	24	25	25	31	19
Muddy Boggy - 2	19910049	Atoka, City of	0	0	0	0	0	0	28	7
Clear Boggy	20060059	Moua, Maydoua	11	2	25	2	25	2	25	2
Clear Boggy	19990026	Helton, Richard J. & Mary Elizabeth	0	0	7	1	27	2	23	2
Muddy Boggy - 2	20080002B	Generic	2,893	21	4,842	24	7,410	24	17	3
Clear Boggy	19820061	Arbuckle Area Council	6	3	11	4	12	4	14	4
Clear Boggy	20020048	McBrayer, Michael & Kara	12	4	12	4	12	4	12	4
Clear Boggy	19650070	Moore, Bill	10	4	10	4	10	4	10	4
Muddy Boggy - 2	19860011	Mack Alford Correctional Center	2	2	2	2	2	2	9	9
Clear Boggy	19940006	DHM Enterprises Inc	3	1	3	1	6	2	8	2
Muddy Boggy - 2	19660424	Vaughn, Ruth	53	14	58	14	82	14	7	2
Clear Boggy	20080002C	Generic	0	0	0	0	16	1	7	1
Clear Boggy	20020012	Howell Family Trust	4	2	4	2	7	3	7	3
Muddy Boggy - 2	20010018	Battles, Kenneth and Mary Alice	0	0	0	0	0	0	7	7
Clear Boggy	19960059_2	Stinchcomb, Roger & Cindy	6	1	6	1	10	2	6	1
Clear Boggy	20070011	Troyer, John	6	2	6	2	6	2	6	2
Clear Boggy	20080021	Mustang Stone Quarries	4	4	4	4	4	4	6	6
Clear Boggy	19930003	Wapanucka Public Works Authority	2	1	2	1	4	2	6	2
Muddy Boggy - 2	19670062	Atoka Co Rural Water District #1	0	0	0	0	0	0	4	4
Clear Boggy	20020011	Howell Family Trust	2	2	2	2	3	3	3	3
Clear Boggy	19960059_B	Stinchcomb, Roger & Cindy	1	1	1	1	3	2	1	1
Clear Boggy	19540198	Bromide, City of	0	0	1	1	1	1	1	1
Muddy Boggy - 2	19700195	Bowen, Eddie & Ronnie	0	0	0	0	0	0	1	1
Muddy Boggy - 2	19800064	Schollenberger, J W	0	0	0	0	0	0	1	1
Muddy Boggy - 2	19990029	Bowen, Eddie & Ronnie	0	0	0	0	0	0	1	1
Clear Boggy	19800140	Hilton, Earl	0	0	0	0	2	1	0	0
Clear Boggy	19760060	Woolley, Jr, Walter	0	0	0	0	1	1	0	0
Muddy Boggy - 1	20060050	Bench, Chester	0	0	0	0	0	0	0	0
Muddy Boggy - 1	20030032	Barker, Jeffery Allen	0	0	0	0	0	0	0	0
Muddy Boggy - 1	19660222	Brown, Edith Ethel	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19990035	Stream Natural Resources L C	0	0	0	0	0	0	0	0
Muddy Boggy - 2	20040009	City of Coalgate	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19730282A	Atoka, City of	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19730282B	County Commissioners of Atoka Co	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19730282C	Southern Oklahoma Development Tr	0	0	0	0	0	0	0	0
Export Muddy Boggy - 2	19730282D	Oklahoma City, City of	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19830053	Kiowa, Town of	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19250005	Kiowa, Town of	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19630174	Coalgate Public Works Authority	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19810003	Clayton, Rick & Kathy	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19930036	Margerum, Floyd	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19880005	Yarbrough, Billy	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19810130	James C Lollar Trust, Carol A Tomlin	0	0	0	0	0	0	0	0
Clear Boggy	20060015	Wood, L Ray	0	0	0	0	0	0	0	0
Clear Boggy	20030006	Mallard Farms LLC	0	0	0	0	0	0	0	0
Clear Boggy	19980016	Ferguson, Joyce	0	0	0	0	0	0	0	0
Clear Boggy	19910017	Houser, Donald	0	0	0	0	0	0	0	0
Clear Boggy	19800032A	Pipes, Velma	0	0	0	0	0	0	0	0
Clear Boggy	19800032B	Lewis, Thomas G	0	0	0	0	0	0	0	0
Clear Boggy	19830055	Tourism & Recreation, Dept of	0	0	0	0	0	0	0	0
Clear Boggy	19640966	Nelson, Howard	0	0	0	0	0	0	0	0
Clear Boggy	19910033	Table Top Ranches	0	0	0	0	0	0	0	0

Clear Boggy	19990018	Consolidated Stone Industries	0	0	0	0	0	0	0	0
Clear Boggy	19910012	Willis, Ron	0	0	0	0	0	0	0	0
Clear Boggy	19580282	Millsap, Van R	0	0	0	0	0	0	0	0
Clear Boggy	20020010	Howell Family Trust	0	0	0	0	0	0	0	0
Clear Boggy	19810076	Collins, Jimmy D	0	0	0	0	0	0	0	0
Clear Boggy	19810179	Reece, Donald J	0	0	0	0	0	0	0	0
Muddy Boggy - 2	19840013	Comstock, T A	0	0	0	0	0	0	0	0
Clear Boggy	19870033	Shipe, John B	0	0	0	0	0	0	0	0
Clear Boggy	19870004	Pogue, Randall	0	0	0	0	0	0	0	0
Muddy Boggy - 1	20080002F	Generic	0	0	0	0	0	0	0	0
Clear Boggy	19780164	Little, B L	0	0	0	0	0	0	0	0
Clear Boggy	19450005	Le Flore, Louie	0	0	0	0	0	0	0	0
Clear Boggy	19930020	Wall, Bobby D & Debbie	0	0	0	0	0	0	0	0
Clear Boggy	19710155	Thomas Ranch	0	0	0	0	0	0	0	0
Clear Boggy	19770024	Thomas Ranch	0	0	0	0	0	0	0	0
Clear Boggy	19640019	Reeves, W E	0	0	0	0	0	0	0	0
Clear Boggy	19770126_4	Cannon, Lilly	0	0	0	0	0	0	0	0
Clear Boggy	20080002A	Generic	0	0	0	0	0	0	0	0
Muddy Boggy - 2	20080002D	Generic	0	0	0	0	0	0	0	0
Muddy Boggy - 1	20080002E	Generic	0	0	0	0	0	0	0	0

Table 6-2: List of Kiamichi Permits with Shortages.

			OCWP 2007		OCWP 2010		OCWP 2030		OCWP 2060	
OCWP Sub Basin	Permit Number	Entity Name	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage
Kiamichi - 2	19980031	Lockhart, Bueford R	38	5	38	5	65	6	127	8
Kiamichi - 2	19980004_1	Wilson, Danny W	35	5	36	5	67	8	124	9
Kiamichi - 2	19660510	Kelley, J R	0	0	0	0	0	0	0	0
Kiamichi - 2	19960001	Trowbridge Brother Farms	0	0	0	0	0	0	0	0
Kiamichi - 2	20070020	Howard, William S	0	0	0	0	0	0	0	0
Kiamichi - 2	19850010	Corbin, Clyde	0	0	0	0	0	0	0	0
Kiamichi - 2	19570376	Wildlife Conservation, Dept of	0	0	0	0	0	0	0	0
Kiamichi - 2	19960028	Kennedy, Michael C. and Debra	0	0	0	0	0	0	0	0
Kiamichi - 2	19910037	Addington McSpadden, Donna	0	0	0	0	0	0	0	0
Kiamichi - 2	19620079	Talihina Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19680415	Talihina Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19880022	Latimer Co Rural Water District #2	0	0	0	0	0	0	0	0
Kiamichi - 2	19910054	Sardis Lake Water Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19980032	Ralston, Leo	0	0	0	0	0	0	0	0
Kiamichi - 2	19620087	Clayton Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19800075	Clayton Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19980005_1	Jackson, Dale	0	0	0	0	0	0	0	0
Kiamichi - 2	19560158	Tourism & Recreation, Dept of	0	0	0	0	0	0	0	0
Kiamichi - 2	19930039_1	Decker Revocable Trust	0	0	0	0	0	0	0	0
Kiamichi - 2	19610143	Miller, Geneva H & Patrick	0	0	0	0	0	0	0	0
Kiamichi - 2	19640593	Debolt, MD, Merlan	0	0	0	0	0	0	0	0
Kiamichi - 2	19560642	Evans, Mrs. M.P.	0	0	0	0	0	0	0	0
Kiamichi - 2	19540874	Antlers Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 2	19820134	Redman, Louise A	0	0	0	0	0	0	0	0
Kiamichi - 2	19860023	Redman, Louise A	0	0	0	0	0	0	0	0
Kiamichi - 2	19930017	Pushmataha Co Rural Water Dist #3	0	0	0	0	0	0	0	0
Kiamichi - 2	19920022	Pushmataha Co Rural Water Dist #3	0	0	0	0	0	0	0	0
Kiamichi - 2	19720060	Antlers Public Works Authority	0	0	0	0	0	0	0	0
Kiamichi - 1	19570121	Wildlife Conservation, Dept of	0	0	0	0	0	0	0	0
Kiamichi - 1	20050001	SCS Materials LLP	0	0	0	0	0	0	0	0
Kiamichi - 1	19660677	Wildlife Conservation, Dept of	0	0	0	0	0	0	0	0
Kiamichi - 1	19720048	Hugo Municipal Authority	0	0	0	0	0	0	0	0
Kiamichi - 1	19540795	Hugo Municipal Authority	0	0	0	0	0	0	0	0
Kiamichi - 1	19770160	Western Farmers Electric Coop	0	0	0	0	0	0	0	0
Kiamichi - 2	19980004_2	Wilson, Danny W	0	0	0	0	0	0	0	0
Kiamichi - 2	19980005_2	Jackson, Dale	0	0	0	0	0	0	0	0
Kiamichi - 2	19930039_2	Decker Revocable Trust	0	0	0	0	0	0	0	0
Kiamichi - 2	19980005_3	Jackson, Dale	0	0	0	0	0	0	0	0
Kiamichi - 1	20000044	Merdian Aggregates Company LP	0	0	0	0	0	0	0	0
Kiamichi - 1	19520394	Leslie, Donald	0	0	0	0	0	0	0	0
Kiamichi - 1	19710567	Leslie, Donald	0	0	0	0	0	0	0	0
Kiamichi - 1	19560472	Wildlife Conservation, Dept of	0	0	0	0	0	0	0	0
Kiamichi - 1	19760079	Critchlow, Charles	0	0	0	0	0	0	0	0
Kiamichi - 1	20080002A	Aggregate Livestock	0	0	0	0	0	0	0	0
Kiamichi - 1	20080002B	Aggregate Oil and Gas	0	0	0	0	0	0	0	0
Kiamichi - 1	20080002C	Aggregate Self Supply Rural Residentia	0	0	0	0	0	0	0	0
Kiamichi - 1	20080002D	Aggregate Self Supply Industrial	0	0	0	0	0	0	0	0
Kiamichi - 2	20080002E	Aggregate Livestock	0	0	0	0	0	0	0	0
Kiamichi - 2	20080002F	Aggregate Oil and Gas	0	0	0	0	0	0	0	0
Kiamichi - 2	20080002G	Aggregate Self Supply Rural Residentia	0	0	0	0	0	0	0	0
Kiamichi - 2	20080002H	Aggregate Self Supply Industrial	0	0	0	0	0	0	0	0

Table 6-3: List of Little River Permits with Shortages.

			OCWP 2007		OCWP 2010		OCWP 2030		OCWP 2060	
OCWP Sub Basin	Permit Number	Entity Name	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage	Volume of All Shortages (AFY)	Count of Months of Shortage
Little River - 2	19820137	Idabel Public Works Authority	33	1	33	1	37	1	67	3
Little River - 3	20080002J	Generic Oil & Gas	10	10	10	10	20	10	35	10
Little River - 2	19480077	McKinney, Fred	0	0	0	0	0	0	0	0
Little River - 2	19550764	Idabel Public Works Authority	0	0	0	0	0	0	0	0
Little River - 2	19610009	Weyerhaeuser NR Company	0	0	0	0	0	0	0	0
Little River - 2	19650005	McKinney, Fred	0	0	0	0	0	0	0	0
Little River - 1	19660337	McCurtain Co Rural Water Dist #1	0	0	0	0	0	0	0	0
Little River - 2	19670059	Weyerhaeuser NR Company	0	0	0	0	0	0	0	0
Little River - 3	19670091	Oklahoma State University	0	0	0	0	0	0	0	0
Little River - 2	19670560	International Paper Company	0	0	0	0	0	0	0	0
Little River - 3	19710083	Mountain Fork Water Supply Corp	0	0	0	0	0	0	0	0
Little River - 3	19740292	Tourism & Recreation, Dept of	0	0	0	0	0	0	0	0
Little River - 3	19750056	Duke, Kathryne	0	0	0	0	0	0	0	0
Little River - 2	19780013	Wilkerson, David	0	0	0	0	0	0	0	0
Little River - 3	19800098	Mountain Fork Water Supply Corp	0	0	0	0	0	0	0	0
Little River - 2	19800132	Valliant, City of	0	0	0	0	0	0	0	0
Little River - 2	19800135	Lovitt, Jean H	0	0	0	0	0	0	0	0
Little River - 3	19800144	Bray, Opal A	0	0	0	0	0	0	0	0
Little River - 3	19820105	Broken Bow Public Works Authority	0	0	0	0	0	0	0	0
Little River - 3	19860015	Broken Bow Public Works Authority	0	0	0	0	0	0	0	0
Little River - 3	19880029_1	Bailey, Joy R	0	0	0	0	0	0	0	0
Little River - 3	19880029_2	Bailey, Joy R	0	0	0	0	0	0	0	0
Little River - 3	19880029_3	Bailey, Joy R	0	0	0	0	0	0	0	0
Little River - 2	19890020	H-Five Inc	0	0	0	0	0	0	0	0
Little River - 2	19890057	Rufe Volunteer Fire Department	0	0	0	0	0	0	0	0
Little River - 2	19900021	Hargadine, Maxine	0	0	0	0	0	0	0	0
Little River - 2	19920021	Sands, Ray	0	0	0	0	0	0	0	0
Little River - 1	19980055	Mulkey, Mary E, Ross, Glenda A	0	0	0	0	0	0	0	0
Little River - 2	20020016	Smith, Bryant & Mavis	0	0	0	0	0	0	0	0
Little River - 2	20080005	JoB Construction Co Inc	0	0	0	0	0	0	0	0
Little River - 1	20080013	Idabel Public Works Authority	0	0	0	0	0	0	0	0
Little River - 1	20080002A	Generic Livestock	0	0	0	0	0	0	0	0
Little River - 2	20080002B	Generic Oil & Gas	0	0	0	0	0	0	0	0
Little River - 3	20080002C	Generic SSI	0	0	0	0	0	0	0	0
Little River - 4	20080002D	Generic SSRR	0	0	0	0	0	0	0	0
Little River - 2	20080002E	Generic Livestock	0	0	0	0	0	0	0	0
Little River - 2	20080002F	Generic Oil & Gas	0	0	0	0	0	0	0	0
Little River - 2	20080002F	Generic Oil & Gas	0	0	0	0	0	0	0	0
Little River - 2	20080002H	Generic SSRR	0	0	0	0	0	0	0	0
Little River - 3	20080002I	Generic Livestock	0	0	0	0	0	0	0	0
Little River - 3	20080002K	Generic SSI	0	0	0	0	0	0	0	0
Little River - 3	20080002L	Generic SSRR	0	0	0	0	0	0	0	0