



**US Army Corps
of Engineers®**

Tulsa District

FINAL

**SUNFLOWER H2O
STATE OF KANSAS
SECTION 22
PLANNING ASSISTANCE TO STATES
WATER SUPPLY AND DEMAND REPORT**

**APPENDIX C
RECREATION ANALYSIS**

**TULSA DISTRICT
U.S. ARMY CORPS OF ENGINEERS**

FEBRUARY 2013

2012

Sunflower H2O Recreation Demand



US Army Corps of Engineers Tulsa District

7/29/2012

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Executive Summary

Sunflower H2O Coalition partnered with the Army Corps of Engineers (USACE) under Planning Assistance to State (PAS) to perform an evaluation of existing and future water supply sources in Barber County, Kansas and the surrounding region. As part of the study, C.H. Guernsey & Company, Oklahoma City, evaluated three surface water sources and three ground water sources for their availability and viability of water supply yield. One potential future location, Elm Creek Reservoir, site was selected for further evaluation of its potential recreation demand. Elm Creek Reservoir site was selected for its size, proximity to Wichita, Kansas, accessibility and triennial Medicine Lodge Peace Treaty Festival held in the nearby town of Medicine Lodge, Kansas.

The preliminary recreation analysis estimates approximately 282,391 visitors annually to the potential reservoir. Over a fourth of the visitation being camping users and the other three quarters being day users. The largest contributing factor to recreation is the proximity to large populations. As of the 2010 Census, Wichita, Kansas has a population of 382,368. Wichita has also experienced substantial growth in the past ten years. The “Teens Outside” national initiative supported by Kansas in their 2009 SCORP¹ (State Comprehensive Outdoor Recreation Plan) identifies a need for opportunities for inner city youth to get outdoors. The Elm Creek Reservoir site could potentially meet the need of providing outdoor recreation and educating the City of Wichita’s urban youth with the wonders of the great outdoors. Possible amenities such as: shared hard surface trails, playground equipment, open space, free ride area, shared use soft surface trails, hiking trails, waterfront and equestrian trails could be provided at the Elm Creek Reservoir site which would fulfill many of the stated preferences documented in the SCORP and the recreation demand for these amenities and contributing to recreation activity in South Central Kansas and North Central/Eastern Oklahoma. While a reservoir with these amenities will be fulfilling some stated recreation demand for the City of Wichita, excess demand will remain. Other activity preferences would likely be unattained. Amenities such as: community parks, special use area sports parks, skate parks, neighborhood park acreage, climbing trails and shooting sports park have a stated preference but are unlikely to be fulfilled by this project.

¹ Teens Outside initiative was first adopted in the 2005 update of the Kansas SCORP

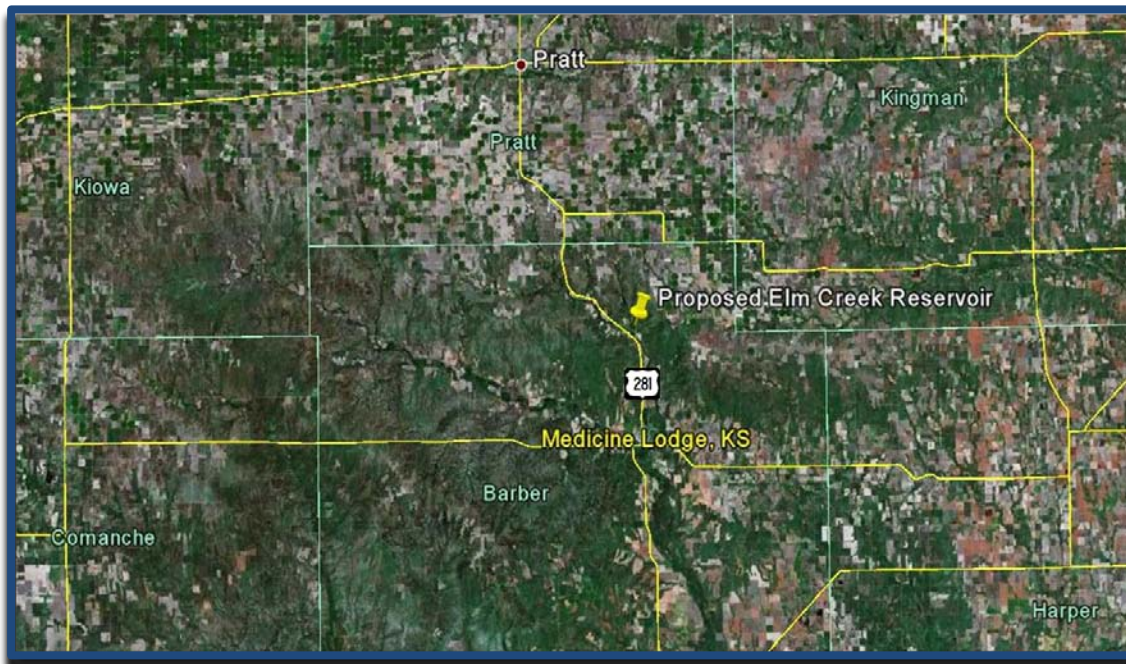
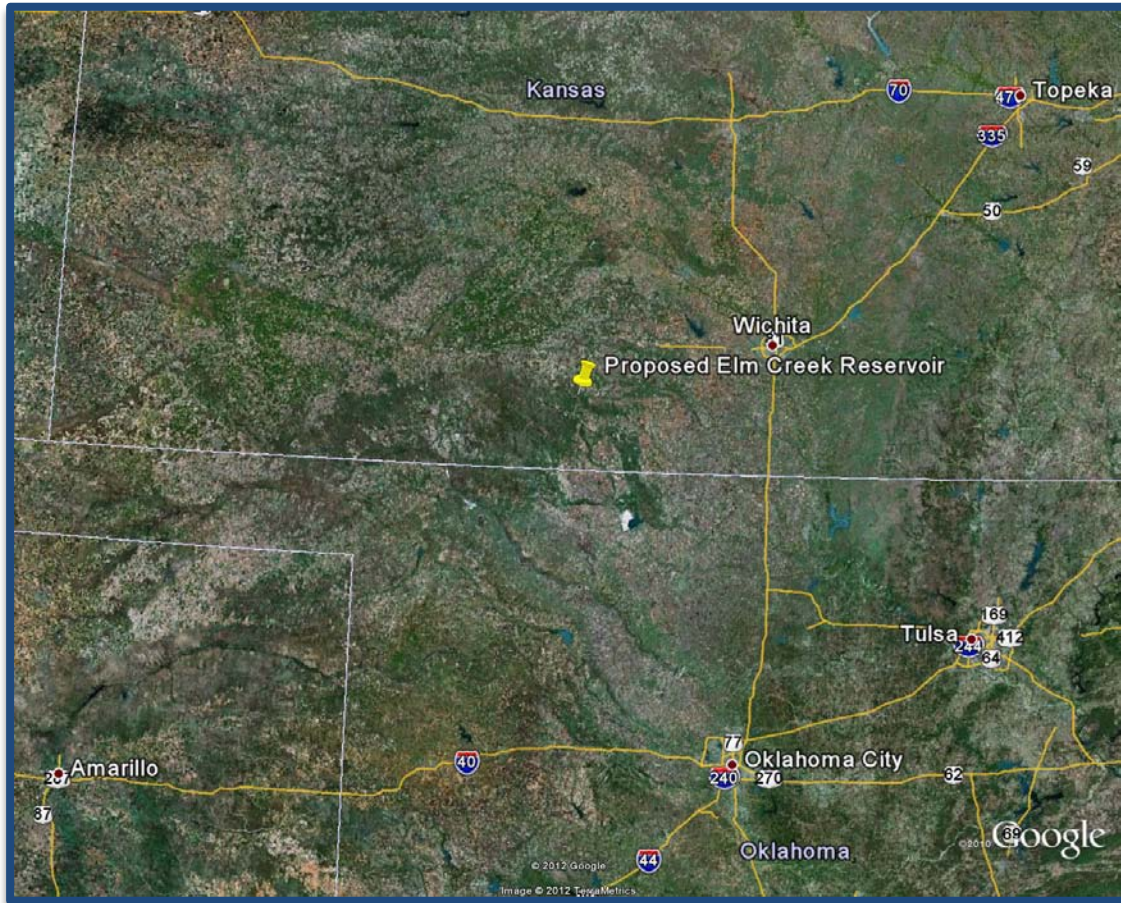
Study Background

Sunflower H2O Coalition began a study to evaluate existing and future surface and ground water supply sources within the H2O coalition service area. With the prospect of a possible Surface water source the question arose “what would be the recreation demand opportunity for a large reservoir in this area?” If there is found to be a water supply need, as well as other desired purposes of a large reservoir, this analysis will serve as an assessment of the transferred and induced recreation demand.

Location

Three locations in Kansas were identified as possible surface water supply sources; Turkey Creek, East Branch Little Sandy Creek and Elm Creek. The Elm Creek Reservoir site was selected for this recreation analysis for its size and accessibility. The proposed dam site is on the Elm Creek located in Barber County, Kansas, approximately seven miles upstream from the mouth of the streams confluence with Medicine Lodge Creek. The Elm Creek Reservoir site would be seventy-two miles west by southwest of Wichita, Kansas, six miles north of Medicine Lodge, Kansas, eighty miles northwest of Enid, Oklahoma and twenty miles south of Pratt, Kansas (see Figure 1). The proposed site would inundate Highway 281; the new location of Highway 281 would provide ideal access for induced recreation infrastructure.

Figure 1 - Vicinity Maps



Source: "Oklahoma and Kansas" 37° 23' 21.55 N and 98° 35' 43.71 W. [Google Earth](#). 9-23-2011. 5-10-2012

Acronyms and Abbreviations

ACS	American Community Survey
ADA	American Disability Act
CPI	Consumer Price Index
CV	Coefficient of Variation
CVM	Contingents Valuation Method
EA	Environmental Assessment
EIS	Environmental Impact Statement
GSP	Great Salt Plains
IMPLAN	IMPact analysis for PLANning
I-O	Input Output
KDWPT	Kansas Department of Wildlife, Parks and Tourism
KS	Kansas
NED	National Economic Development
NEPA	National Environmental Policy Act
OK	Oklahoma
RED	Regional Economic Development
RRDM	Regional Recreation Demand Model
RV	Recreational Vehicle
SAM	Social Accounting Matrix
SCORP	State Comprehensive Outdoor Recreation Plan
TCM	Travel Cost Method
TDS	Total Dissolved Solids
USACE	United States Army Corps of Engineers
UDV	Unit Day Value
WTP	Willingness To Pay
WMA	Wildlife Management Area

Chapter 1- Current Recreation and Demographics

1.1-Kansas SCORP

Kansas Department of Wildlife, Parks and Tourism (KDWPT) updated the State of Kansas Comprehensive Outdoor Recreation Plan (SCORP) in 2009. The Kansas SCORP provides an inventory of outdoor recreation supply. The Kansas SCORP also lists areas of priority, challenges and goals to be focused on for the next five years. The Elm Creek Reservoir site could potentially fit in the SCORP and Strategic Plan to: 1) expand efforts to develop and conduct outdoor recreation skills clinics and education programs, particularly in urban areas; 2) continue and expand urban nature centers, nature trails and wildlife and wildflower viewing opportunities for urban residents; 3) develop and publish youth oriented information and education materials related to outdoor recreation pursuits. With the close proximity to Wichita these strategies of urban recreation activities by targeting Wichita's youth with clinics and education programs such as "Take Me Fishing" potentially fits into the overall Kansas initiative of the SCORP. Collaboration with the Outdoor Foundation, National Recreation and Park Association, recreation districts, and the KDWPT as well as others could provide synergy in meeting these goals.

1.2-Local Substitutes

Section 1.2.1 Substitutes by Activities

A parallel initiative by KDWPT was to develop a database for outdoor recreation opportunities. This database Recreation Finder² was used to inventory the existing recreation supply in this area.

- Public parks that offer swimming within a 50³ mile radius of the proposed site are listed here: Achembach Memorial Park in Hardner, Anthony Swimming Pool and Park in Anthony, Cunningham Lions Park in Cunningham, Gebhart Park in Pratt, McFadden Park in Attica, Progress Park in Kiowa, Riverside Park in Kingman, Ruth Street Park in Haviland, Stafford Swimming Pool Park in Stafford and Turon City Park in Turon
- Public parks offering boating within a 50 miles radius; Kingman State Fishing Lake and Bryan Walker Wildlife Management Area (WMA) in Kingman and Pratt County Lake and Park in Pratt. These sites offer fishing as well with the inclusion of Anthony Municipal Lake and Park ¾ of a mile North of Anthony on Highway 2 and Barber County State Fishing Lake and WMA ¼ mile north of Medicine Lodge.

² Kansas Department of Wildlife Parks and Tourism (KDWPT); Kansas Recreation finder; <http://maps.kansasgis.org/recfinder/public/index.cfm>

³ Fifty mile radius used here in the database assessment not related to the eighty mile radius of the overall analysis.

Section 1.2.2 Substitutes by Similar Reservoirs

A similar reservoir usually describes similarities in geography, size, depth, water quality or appearance. For the purposes of this preliminary assessment, similar reservoirs are defined based on activities provided, rather than geography or other listed feature. The previous section included those sites that may not have the compilation of several activities. This section documents those locations with similar activities and the water recreation opportunities. The reservoirs in this section include reservoirs in which users within an eighty mile radius have the decision of selecting the Elm Creek Reservoir site over another reservoir within an eighty mile radius from which they reside. For example: Sooner Lake is listed for its effect as a substitute for those living in the Enid region of Oklahoma who may choose to visit the proposed Elm Creek Reservoir. Kansas and Oklahoma populations within the eighty mile influence radius of the Elm Creek Reservoir site has substitute options within eighty miles of their home. Table 1 shows an account of all recreation substitutes' options for the population with the option to visit the proposed Elm Creek Reservoir.

Table 1 – Surface Area, Visitation, and Campsite for Substitute Reservoir

Substitute Reservoir	Surface area/acres	2010 Visitation	Camp sites
Cheney Reservoir, KS	9,537	480,121**	223/400 ⁴
Great Salt Plains, OK	25,660	198,860*	159
Canton Lake, OK	7,910	769,139*	342
Kaw Reservoir, OK	16,750	216,631*	305
Fort Supply Lake, OK	1,820	302,175*	135
Timber Creek Lake, KS	1,050	N/A	N/A
Wilson Lake, KS	9,100	232,562*	474
El Dorado Lake, KS	7,997	1,053,747*	978
Marion Lake, KS	6,210	402,032*	206
Kanopolis Lake, KS	3,400	277,086*	378
Cedar Bluff Reservoir, KS	17,600	165,736**	N/A
Foss Reservoir, OK	6,800	N/A	N/A
Sooner Lake, OK	5,400	N/A	N/A
Lake Carl Blackwell, OK	3,350	N/A	N/A
Lake McMurtry, OK	1,300	N/A	N/A
Fall River Lake, KS	2,800	141,894*	240
Toronto Lake, KS	2,350	138,213*	70
Arcadia Lake, OK	1,820	619,623*	188
John Martin, CO	20,515	197,509*	213
Optima Lake, OK	5,340	23,383*	0

Source: *USACE **KDWPT

⁴Electric hook-ups/primitive camp: KDWPT; Camping reservation system. <http://kdwpt.state.ks.us/State-Parks/Reservations>

1.3-Demographics

Demographic information provides background to the socioeconomic conditions of a region. Typical socioeconomic sections such as those found in an Environmental Impact Statement consist of; population, age, income, race and education of the population. Information provided in Table 2 is from the 2010 U.S Census Bureau for the sixteen Kansas and seven Oklahoma county regions. The sixteen Kansas counties are; Barber, Barton, Clark, Comanche, Edward, Ford, Harper, Kingman, Kiowa, Pawnee, Pratt, Reno, Rice, Sedgwick, Stafford, and Sumner. The seven Oklahoma counties are; Alfalfa, Garfield, Grant, Harper, Major, Woods, and Woodward.

1.3.1 Population

Table 2 – Kansas and Oklahoma Population

Geography	2000 Total	2010 Total	2000-2010 Change	Percent change
Kansas	2,688,418	2,853,118	164,700	6.13
Barber County, Kansas	5,307	4,861	-446	-8.40
Barton County, Kansas	28,205	27,674	-531	-1.88
Clark County, Kansas	2,390	2,215	-175	-7.32
Comanche County, Kansas	1,967	1,891	-76	-3.86
Edwards County, Kansas	3,449	3,037	-412	-11.95
Ford County, Kansas	32,458	33,848	1,390	4.28
Harper County, Kansas	6,536	6,034	-502	-7.68
Kingman County, Kansas	8,673	7,858	-815	-9.40
Kiowa County, Kansas	3,278	2,553	-725	-22.12
Pawnee County, Kansas	7,233	6,973	-260	-3.59
Pratt County, Kansas	9,647	9,656	9	0.09
Reno County, Kansas	64,790	64,511	-279	-0.43
Rice County, Kansas	10,761	10,083	-678	-6.30
Sedgwick County, Kansas	452,869	498,365	45,496	10.05
Stafford County, Kansas	4,789	4,437	-352	-7.35
Sumner County, Kansas	25,946	24,132	-1,814	-6.99
Oklahoma	3,450,654	3,751,351	300,697	8.71
Alfalfa County, Oklahoma	6,105	5,642	-463	-7.58
Garfield County, Oklahoma	57,813	60,580	2,767	4.79
Grant County, Oklahoma	5,144	4,527	-617	-11.99
Harper County, Oklahoma	3,562	3,685	123	3.45
Major County, Oklahoma	7,545	7,527	-18	-0.24
Woods County, Oklahoma	9,089	8,878	-211	-2.32
Woodward County, Oklahoma	18,486	20,081	1,595	8.63
Regional Total	776,042	819,048	43,006	5.54

Source: U.S. Census Bureau

Several counties had negative growth (percent change) from 2000 to 2010 based on U.S. Census data. As a region or accumulation of counties the growth was positive at 5.54%. This can mostly be attributed to the growth of Sedgwick and Ford Counties in Kansas and Garfield and Woodward Counties in Oklahoma

with 10.05, 4.28, 4.79 and 8.63 percent growth, respectively. Metropolitan (cities with above 50,000 residents) areas such as Wichita Kansas and micropolitan (cities with 10,000-49,999 residents) areas such as Dodge City Kansas, Woodward and Enid Oklahoma can further assist in defining the growth in this region. A few micropolitan and metropolitan cities growth can be found in Table 3.

Table 3 - City Growth

City	2000 Population	2010 Population	10 Year Percent Change
Wichita, Kansas	344,284	382,368	11%
Dodge City, Kansas	25,176	27,340	9%
Hutchinson, Kansas	40,787	42,080	3%
Pratt, Kansas	6,570	6,835	4%
Enid, Oklahoma	47,045	49,379	5%
Woodward, Oklahoma	11,853	12,051	2%

Source: U.S. Census Bureau

1.3.2 Median Age

Median age also gives insight to the types of activities that will be in higher demand. Median age of populations can give indication to the distribution of elderly and youth populations within the region. Age distributions have two different considerations in recreation assessments; visitation numbers and type of recreation activity utilized. Younger populations may visit more regularly than working adults; however, older populations typically partake in a different activity types. Older population typically partakes in higher valued activities such as sailing, house boating and resort amenities. A recreation analysis can consist of both demand/visitation and activity valuation. This analysis focuses on demand/visitation and the methodology herein accounts for age distribution in the population. Additional information about median age effects is located in the Model Variables section (2.4). Table 4 shows Kansas and Oklahoma median age as well as the twenty three counties in the region.

Table 4 – 2010 Median Age

Geography	Median age (years)		
	Both sexes	Male	Female
Kansas	36.0	34.7	37.4
Barber County, Kansas	45.8	44.4	46.6
Barton County, Kansas	39.7	38.0	41.4
Clark County, Kansas	44.9	42.3	47.7
Comanche County, Kansas	47.4	46.7	48.4
Edwards County, Kansas	44.8	44.7	44.9
Ford County, Kansas	30.4	29.5	31.5
Harper County, Kansas	44.1	41.8	46.7
Kingman County, Kansas	44.5	43.4	45.7
Kiowa County, Kansas	41.9	41.6	42.3
Pawnee County, Kansas	43.2	41.1	46.5
Pratt County, Kansas	40.9	38.5	43.8
Reno County, Kansas	39.9	37.9	42.1
Rice County, Kansas	39.3	36.9	42.0
Sedgwick County, Kansas	34.2	33.4	35.1
Stafford County, Kansas	45.6	44.1	46.9
Sumner County, Kansas	40.5	38.9	42.0
Oklahoma	36.2	34.9	37.7
Alfalfa County, Oklahoma	46.0	45.3	47.9
Garfield County, Okla.	37.4	35.6	39.0
Grant County, Oklahoma	45.8	45.3	46.2
Harper County, Oklahoma	40.2	38.5	41.5
Major County, Oklahoma	43.7	42.9	44.4
Woods County, Oklahoma	34.7	31.2	40.5
Woodward County, Okla.	37.0	36.1	38.1

Source: U.S. Census Bureau

Sedgwick and Ford counties Kansas (34.2 and 30.4) have a considerably lower median age than the state average for Kansas. This is likely due to the presence of urban areas in both Ford County with Dodge City and Sedgwick County with Wichita. The younger population trend is to move to urban area in search of jobs and education. This indicates rural counties contain the bulk of the older populations above the state average median age however not a trend of older population moving to rural areas. This indicator is consistent in the Oklahoma Counties as well; with Woodward, Woods and Garfield counties having the lowest median age in the region. However, only Woods County has a median age population lower than that of the State of Oklahoma. Northwestern Oklahoma State University presides in the rural community of Alva in Woods County, which may explain the lower median age. Alva with its younger population could provide a marketing opportunity to attract younger visitors as swimming area day users. More discussion on user group targeting can be found in the Marketing User Groups Section 4.2.

1.3.3 Income

Per capita income information gives insight to the economic condition within the region. This area of Kansas and Oklahoma is traditionally agriculture industry based, which correlates with most of the States of Kansas and Oklahoma. With similar industry base, the counties in the region should not vary much from the state averages. In fact only four counties, Ford, Kiowa, Pawnee and Rice Counties Kansas, differed significantly from the state average. Table 5 shows per capita income for the States of Kansas and Oklahoma as well as the twenty-three county study region.

Table 5 – 2010 Per capita income

Geography	Per capita income (dollars)
Kansas	25,907
Barber County, Kansas	23,542
Barton County, Kansas	23,688
Clark County, Kansas	24,605
Comanche County, Kansas	22,974
Edwards County, Kansas	24,899
Ford County, Kansas	19,348
Harper County, Kansas	22,467
Kingman County, Kansas	22,861
Kiowa County, Kansas	19,430
Pawnee County, Kansas	17,927
Pratt County, Kansas	23,585
Reno County, Kansas	22,149
Rice County, Kansas	19,316
Sedgwick County, Kansas	25,297
Stafford County, Kansas	23,171
Sumner County, Kansas	23,114
Oklahoma	23,094
Alfalfa County, Oklahoma	21,029
Garfield County, Oklahoma	22,812
Grant County, Oklahoma	22,204
Harper County, Oklahoma	23,693
Major County, Oklahoma	24,897
Woods County, Oklahoma	24,292
Woodward County, Oklahoma	24,635

Source: U.S. Census Bureau

1.3.4 Race

Race distributions can attribute to different recreation preferences. Future recreation facility planning can benefit greatly in the use of race distributions to accommodate larger groups. For example, studies have established that Hispanic visitors tend to be more family and large group oriented when visiting outdoor recreation areas (Dwyer 1994). Such trends would call for facilities to accommodate large

groups. National Environmental Policy Act (NEPA) and Presidential Memorandum, Environmental Justice for Minority Populations memorandum stipulates to document any adverse impact to low income or minority groups. Information in Tables 5, 6 and 7 can assist in any documentation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS).

Table 6 – 2010 Kansas Race Distribution

Kansas		
Race	Number	Percent
Total population	2,853,118	100.0
One race	2,767,185	97.0
White	2,391,044	83.8
Black or African American	167,864	5.9
American Indian and Alaska Native	28,150	1.0
Asian	67,762	2.4
Native Hawaiian and Other Pacific Islander	2,238	0.1
Some Other Race	110,127	3.9
Two or More Races	85,933	3.0
Two races	80,110	2.8

Source: U.S. Census Bureau

Table 7 – 2010 Oklahoma Race Distributions

Oklahoma		
Race	Number	Percent
Total population	3,751,351	100.0
One race	3,530,030	94.1
White	2,706,845	72.2
Black or African American	277,644	7.4
American Indian and Alaska Native	321,687	8.6
Asian	65,076	1.7
Native Hawaiian and Other Pacific Islander	4,369	0.1
Some Other Race	154,409	4.1
Two or More Races	221,321	5.9
Two races	209,404	5.6

Source: U.S. Census Bureau

1.3.5 Education

Education distributions can attribute to different recreation preferences. No conclusive analysis was conducted within the model to adapt for any difference in recreation preferences based on education. Similar to race, education can contribute to recreation facility preferences. Information in Tables 8 and 9 documents the education levels of the twenty three county region of Kansas and Oklahoma. Table 9 shows the slight increase in Bachelor and Graduate degrees in Woods County, Oklahoma and Sedgwick County, Kansas with the campuses of Northwestern Oklahoma State University and Wichita State

University in these counties, respectively. Collaboration with either of these colleges could fulfill the strategic plan of the Kansas SCORP to expand efforts to develop and conduct outdoor recreation skills clinics and education programs particularly in urban areas, as well as publishing youth oriented information and education materials related to outdoor recreation pursuits.

Table 8 - Education Attainment for Study Region

County, State	Total Population	Less than high school graduate**	High school graduate	Some college or associate's degree	Bachelor's degree	Graduate or professional degree
Barber County, Kansas	3,480	284	1,180	1,365	460	191
Barton County, Kansas	18,170	2,616	5,674	6,154	2,552	1,174
Clark County, Kansas	1,557	130	580	540	248	59
Comanche County, Kansas	1,382	101	569	486	153	73
Edwards County, Kansas	2,203	377	639	723	366	98
Ford County, Kansas	19,233	5,862	4,962	5,094	2,224	1,091
Harper County, Kansas	4,198	587	1,452	1,474	441	244
Kingman County, Kansas	5,546	629	1,768	2,028	762	359
Kiowa County, Kansas	1,767	182	605	610	233	137
Pawnee County, Kansas	4,901	587	1,675	1,811	551	277
Pratt County, Kansas	6,427	673	1,900	2,394	875	585
Reno County, Kansas	42,998	5,309	13,783	15,840	5,617	2,449
Rice County, Kansas	6,641	797	2,364	2,092	969	419
Sedgwick County, Kansas	306,701	37,702	88,267	96,412	57,175	27,145
Stafford County, Kansas	3,085	380	998	1,067	477	163
Sumner County, Kansas	15,892	1,473	5,745	5,704	2,122	848
Alfalfa County, Oklahoma	4,296	788	1,531	1,208	535	234
Garfield County, Okla.	38,865	5,584	14,284	10,536	6,014	2,447
Grant County, Oklahoma	3,212	321	1,187	1,035	420	249
Harper County, Oklahoma	2,467	393	1,032	619	299	124
Major County, Oklahoma	5,254	739	2,220	1,431	624	240
Woods County, Oklahoma	5,628	666	1,823	1,537	1,021	581
Woodward County, Okla.	13,230	2,212	5,108	3,612	1,730	568

Source: U.S. Census Bureau

** Less than High School includes preschool ages

Table 9 - Education Attainment in Percents

Geography State and County	Some college	Associate degree	Bach degree	Graduate degree	High school graduate or <	Bach. degree or <
Kansas	23.7%	7.3%	19.3%	10.1%	89.2%	29.3%
Barber	30.9%	8.3%	13.2%	5.5%	91.8%	18.7%
Barton	25.7%	8.1%	14.0%	6.5%	85.6%	20.5%
Clark	23.3%	11.4%	15.9%	3.8%	91.7%	19.7%
Comanche	29.60%	5.6%	11.1%	5.3%	92.7%	16.4%
Edwards	24.6%	8.2%	16.6%	4.4%	82.9%	21.1%
Ford	19.1%	7.4%	11.6%	5.7%	69.5%	17.2%
Harper	27.7%	7.40%	10.5%	5.8%	86.0%	16.3%
Kingman	27.9%	8.6%	13.7%	6.5%	88.7%	20.2%
Kiowa	25.6%	8.9%	13.2%	7.8%	89.7%	20.9%
Pawnee	30.2%	6.8%	11.2%	5.7%	88.0%	16.9%
Pratt	27.5%	9.8%	13.6%	9.1%	89.5%	22.7%
Reno	27.8%	9.1%	13.1%	5.7%	87.7%	18.8%
Rice	25.7%	5.8%	14.6%	6.3%	88.0%	20.9%
Sedgwick	24.8%	6.7%	18.6%	8.9%	87.7%	27.5%
Stafford	25.9%	8.7%	15.5%	5.3%	87.7%	20.7%
Sumner	28.4%	7.5%	13.4%	5.3%	90.7%	18.7%
Oklahoma	23.5%	6.7%	15.2%	7.4%	85.4%	22.6%
Alfalfa	24.8%	3.3%	12.5%	5.4%	81.7%	17.9%
Garfield	20.8%	6.3%	15.5%	6.3%	85.6%	21.8%
Grant	26.3%	5.9%	13.1%	7.8%	90.0%	20.8%
Harper	21.7%	3.4%	12.1%	5.0%	84.1%	17.1%
Major	24.6%	2.6%	11.9%	4.6%	85.9%	16.4%
Woods	24.4%	2.9%	18.1%	10.3%	88.2%	28.5%
Woodward	24.1%	3.2%	13.1%	4.3%	83.3%	17.4%

Source: U.S. Census Bureau

Chapter 2 – Potential Elm Creek Reservoir Recreation

2.1-Visitation Estimate

The visitation estimate was calculated using a Regional Recreation Demand Model (RRDM). RRDM is a regional regression demand model based on spatially referenced demographic variables and their effects on recreation demand. The methodology is discussed in the next two sections. The visitation is broken down into three zones of influence based on future visitors travel distance. The three zones are listed in Table 10 along with their visitation estimates by zone. Reno, Sedgwick and Garfield counties were later extracted from the zones and added separately to exemplify their effects. For travel cost and distance purposes Reno County correlates with zone 2 and Sedgwick and Garfield counties correlates with zone 3. Figure 3 also illustrates the geographical inclusion of zonal influence on the recreation consumer demand curve. The consumer demand curve is based on the travel and opportunity cost of a recreation activity and the number of trips (units) bought at the given cost (price). Counties were categorized into zonal influence groups based on similar distance to the proposed reservoir. Zonal categorization is consistent with the relatively similar number of trips per year by residents in each zone. Figure 2 illustrates the consumers’ demand curve for the recreation opportunity. As the trip is less expensive (closer) each household visits more per year. As the households’ cost per year goes up the number of visits go down.

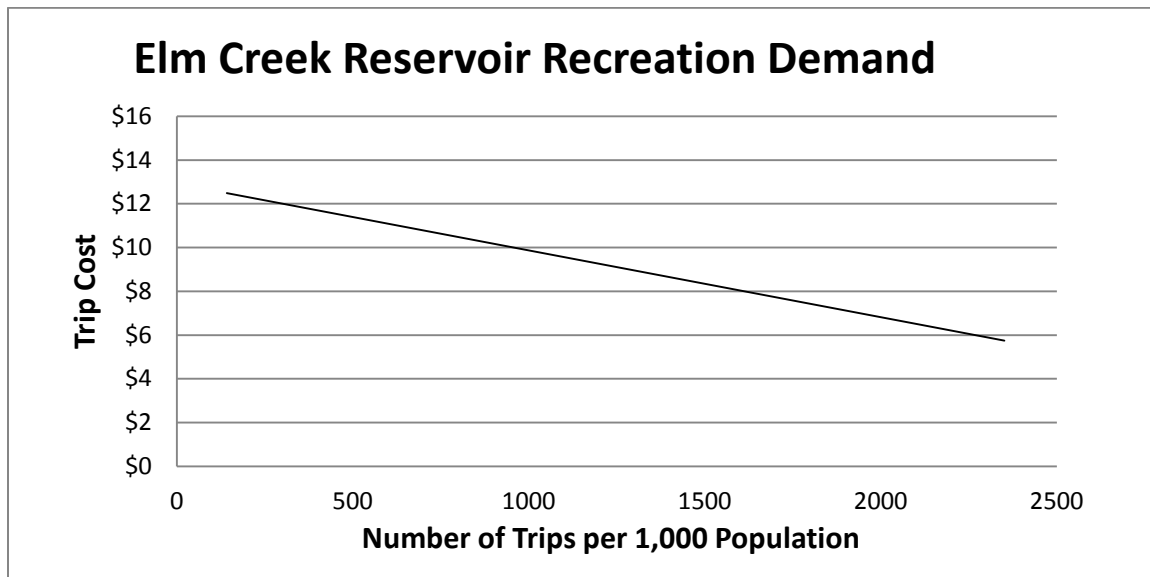
Table 10 - Elm Creek Reservoir Yearly Visitation Estimate

Visitation by zone and type			
	Day use	Camp	Total
Zone 1-30 miles	41,650	25,134	66,784
Zone 2-60 miles	16,788	6,635	23,423
Reno County	39,322	4,667	43,989
Zone 3-80 miles	46,811	4,859	51,671
Sedgwick County	76,029	11,942	87,971
Garfield County	6,507	2,048	8,554
Total	227,107	55,284	282,391

Source: Elm Creek RRDM

This visitation estimates is a compilation of all activities likely to take place at the Elm Creek Reservoir site. The stated preference for amenities found in the SCORP correlates with activities likely to take place at the Elm Creek Reservoir site. Amenities such as: shared hard surface trails, playground equipment, open space, free ride area, shared use soft surface trails, hiking trails, waterfront and equestrian trails could be provided at the Elm Creek Reservoir site which would fulfill many of the stated preferences documented in the SCORP and the recreation demand for these amenities and contributing to recreation activity in South Central Kansas and North Central/Eastern Oklahoma.

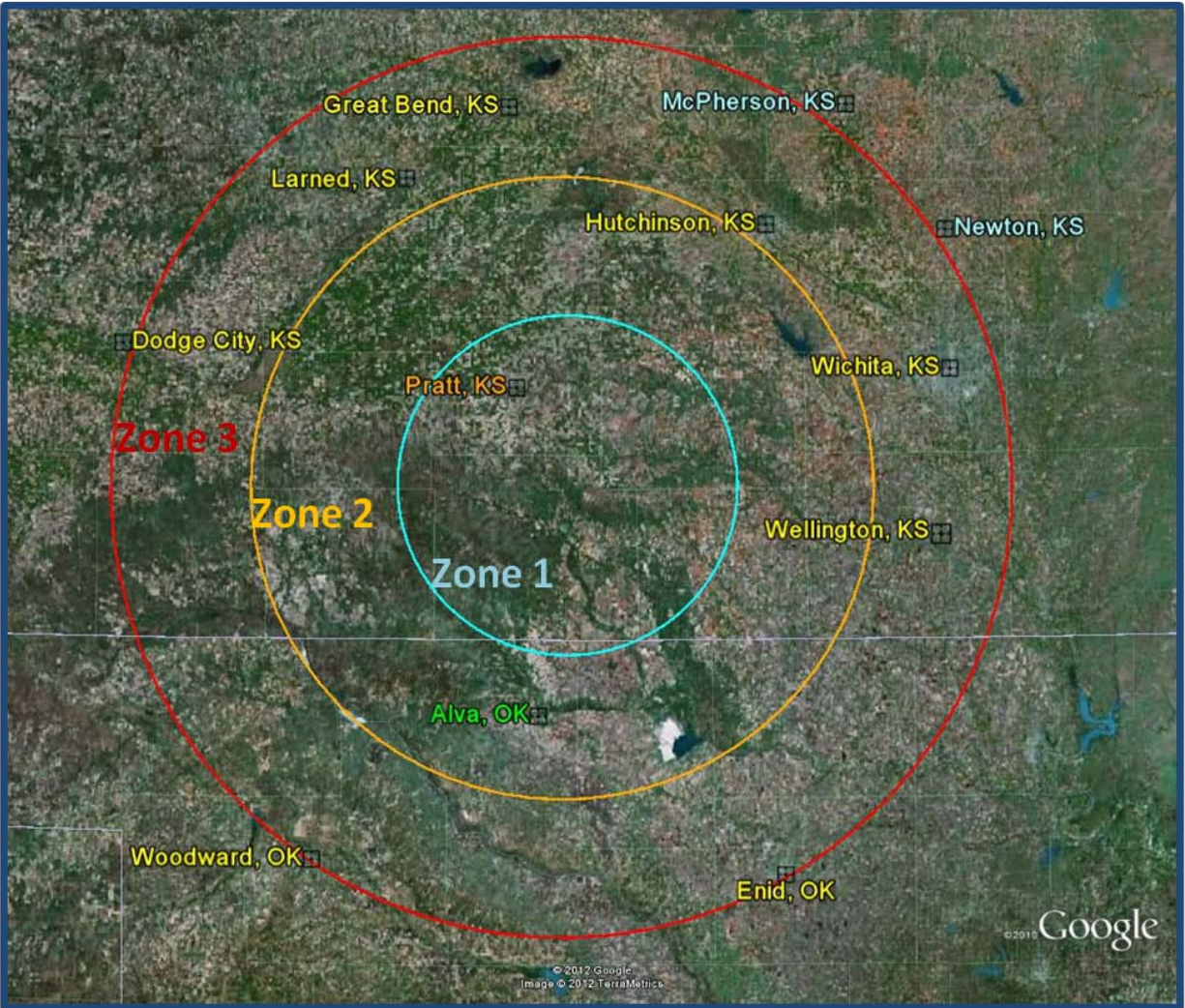
Figure 2 - Elm Creek Reservoir Demand Curve



Source: Elm Creek RRDM

Figure 3 illustrates geographical location of the Zones. Zones were established in thirty mile increments around the proposed Elm Creek Reservoir for the first two zones and an eighty mile radius for the third zone. Residents in Zone 1 are estimated to be closer to the average of three for annual visitation as an aggregate for the population. As shown in Figure 2, populations with a trip cost of \$6 to recreate will provide 2,300 visitors per one thousand people. Those in Zone 2 who pay more to get to the proposed recreation location will on average visit once annually. Residents in Zone 3 will on average visit less than once. The likely outcome is that some households will increase visitation to this reservoir due to personal preference. In this instance an individual household may visit the reservoir many more than three times in a given year. The other part of that outcome is that some households within these zones will choose a different reservoir for their recreation experience or choose no water recreation at all. Combining both of these households and every other household in the region provides the aggregate. Those in Zone 1 who are currently faced with high travel cost to recreation sites will obtain the most value with the construction of a closer recreation opportunity. The value created is their travel cost savings by going to the new reservoir over visiting their old preference. This will also lead Zone 1 and some of Zone 2 populations to take more trips per year, actually inducing new recreation. Similarly, some of those in Zone 2 and Zone 3 will have similar travel costs with and without the Elm Creek Reservoir site. Those populations will continue to experience the same value and only transfer their visitation from an existing reservoir to this one. To the extent that visitation is transferred or induced is not discovered in this assessment. Further discussion on benefits methodology can be found in Benefits Measure Methodology section 3.1. Further discussion on demand theory and study methodology can be found in the next section Methodology 2.2.

Figure 3 - Travel Cost Influence



Source: "Oklahoma and Kansas" 37° 23' 21.55 N and 98° 35' 43.71 W. [Google Earth](#). 9-23-2011. 5-10-2012

As Table 10 shows, Zone 3 as well as Sedgwick County is the largest contributor to visitation. High visitation from Zone 3 and Sedgwick County is to be expected due to the large population centers (illustrated by yellow labels in Figure 3) located in this Zone. Wellington KS, Wichita KS, Hutchinson KS, Great Bend KS, Larned KS, Dodge City KS, Woodward OK, and Enid OK all fall in Zone 3. The orange labeled city (Pratt KS) falls in Zone 1. Populations in Pratt and other Zone 1 cities will likely visit more per household; however there are fewer households than the other Zones. Green labeled cities (Alva OK) fall in Zone 2. Zone 2 populations have increasingly more opportunities of choosing substitute recreation sites. Blue labeled cities (Newton and McPherson KS) fall outside the eighty mile radius, and are likely to contribute minimal effects on real visitation. The estimate does not account for any populations outside the last zone. The substitution possibilities and travel cost of these populations' causes them to have very little real effect on the estimate. However, populations outside the region will participate in unique events at the reservoir. Unique events could include; fishing tournaments, music/art festivals or even the Medicine Lodge Peace Treaty Festival held every three years. See Section 2.6 Uniqueness Variable.

2.2-Methodology

The methodology used for this analysis was the Travel Cost Method (TCM). Outdoor recreation demand is based on consumer discrete choice theory. The consumer choice for outdoor recreation is primarily based on willingness to pay (WTP) for the outdoor recreation service. A visitor to the proposed reservoir will face the decision of how much they are willing to pay for the outdoor experience. Visitors' willingness to pay is more than the entry fee cost, travel expense, and opportunity lost in doing something else. Potential users not willing to pay these costs for the experience will choose to not participate or select an alternative activity or location. Entry fees are constant across all users, however their travel expense and opportunity cost differ across the population based on distance/location from which they originate. Theory suggests that as the population is further from the proposed reservoir their travel costs and opportunity costs increase and the percentage of the population visiting decreases (See figure 4). For example: The average recreation user in zone A will visit the proposed reservoir three times a year, the same average recreation user in zone B will use the resource only one and a half times in a year and the same user in zone C only visits less than one time in a given year. Figure 4 should look similar to the picture in Figure 3. As the populations costs go up for the outer zones their visits go down (See Figure 5). The relationship between the price/cost and the quantity demanded is the demand curve. This is the outline for a demand analysis using travel cost method. Even if the visit contribution is more in the outer zone it is the percentage of that population contributing to the visitation which is used in TCM. In the current analysis, the visitation is largest from zone three; however, the percentage of zone three populations contributing to the total visitation is the smallest of all zones. Consumer surplus is the difference between the maximum amount someone will pay for a resource and the actual price paid for the goods or services (Ward 1995). Consumer surplus estimates can be included in this analysis with the inclusion of the WTP values along the demand curve. Consumer surplus for all users is the area above the travel cost line and below the demand/willingness to pay line. Benefits/consumer surplus is discussed more in Chapter 3 benefits section.

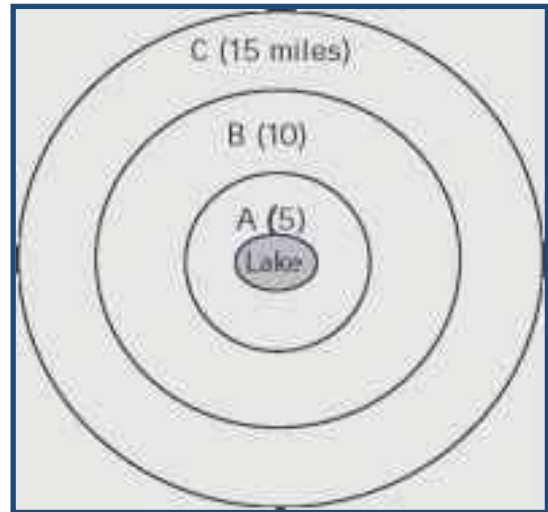


Figure 4 - Travel Cost Method

Source: Institute for Water research, USACE

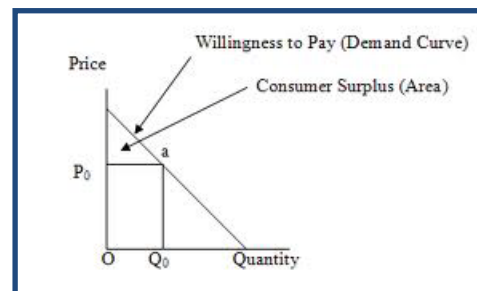


Figure 5 - Willingness to Pay

Source: *American Consumer Institute, Larry

2.3-Model

Outdoor recreation demands models can consist of either primary data from a survey or use of an existing model and applying a benefits transfer technique relying on secondary data. Both types consist of using travel cost methodologies to ask a series of questions about recreation users' behavior as it is related to the costs of a particular recreation experience. Regional demand regression models based on statistical data are capable of using several observations at similar reservoirs to estimate the demand curve and relationship described in the previous section. The Regional Recreation Demand Model (RRDM) was developed in 1995 for the Little Rock District of the U.S. Army Corps of Engineers (USACE) as a forecast tool to evaluate management practices. The RRDM consists of regression analysis of local demographic variables and project variables to find their effects on visitation at the observed reservoir. A list of these variables and their description can be found in Table 11.

Table 11 - Model Variables

Demographic Variables	Variable Descriptions
Population	2010 county population
Income	2010 per capita income
Total cost	Travel cost of recreation user.
Substitute index	Sum of the lake level over distance indexes which apply to all substitute lakes.
<18	Percentage of population under eighteen or percent of total population minus population over eighteen population (2010 population)
Minority	Percentage of minority population per county
project variables	
Sur_acres	reservoir surface acres covered at normal level
Lanes	boat launching lanes
Beaches	public swimming beaches and swimming areas
Marinas	Description being a 150 slip marina. A 300 slip marina would count as 2
Docks	public courtesy docks, could include heated fishing docks
Parking	actual parking spaces, at boat launching facilities
Picnic	public picnic tables
Camps	primitive camping site, adjustment of 1.5 for a improved camped site
TDS	total dissolved solids
Species	Number of sought after sport fish species
Ocean	Miles to the nearest ocean
CV	Coefficient of variation in lake level variations
pct_full	Percent full- a variable that captures the extreme variability of lake levels

Source: Frank Ward. Regional Recreation Demand Model for Large Reservoirs-1995

The close geographical proximity of the model development location, USACE Little Rock District, Arkansas makes this model relatively easy to adapt to the Elm Creek Study Region in Kansas. The Little Rock District sites surveyed include;

- Beaver Lake
- Blue Mountain Lake
- Bull Shoals Lake
- Lake Dardanelle
- Millwood Lake
- Nimrod Lake
- Norfolk Lake
- Table Rock Lake

The Little Rock District RRDM also has an explanation power of $R^2 = .672$ meaning that about 70% of the variables which explain visitation at the observed reservoir can be captured by the model variables. Only predicting 70% of the variability does not mean that 30% more visitors should be added to this estimate. It simply means that 30% of the variability in visitation is not defined by the listed model variables. A new emerging area of undefined variability is climate change. Climate change is the possibility of long term weather patterns changing in severity or frequency for a given region, this area of uncertainty could cause potential recreation users to change their behavior without providing a good variable in which to predict or account for their variation. Other variables including Leisure time, generational popularity trends, and the state of the economy or changes at alternative recreation sites also leave recreation estimates without a measurable indicator of the change. For the sake of most model/estimates this variability is typically referred to as random variability.

2.4-Model Variables

2.4.1 Demographic Variables

- Population- The population of each county in the 2010 Census results were used for its accuracy. The use of 2012 American Community Survey results would add error to this estimate. The 2000 and 2010 census data were used to forecast 2013, 2014 and 2015 visitation estimates. This forecast can be found in Chapter 3 Forecast.
- Income- Model specification describes per capita income variable as per capita income equal to total income revenue in county (j) divided by population (I) of county (j). Per capita income from the American Community Survey (ACS) was significantly higher than this method of population sum divided by income sum of a county and was the bases for the sensitivity analysis. The risk, uncertainty and variability of the two will be addressed in Section 3.4 Risk and Uncertainty. Income used in this model were indexed back to 1995 prices levels to be consistent with the purchasing pattern at the time of the model origination. In short, the change in income used here is that change above the consumer price index (CPI) change. CPI is a measure of all goods/services increasing in price but not value. As the price of other goods and services increases they require more of the consumer's disposable income.
- Total Cost equation is: Total costs of individual (i) from county (j) with costs (k) means the variable cost per mile multiplies by the individual (i) from county (j) plus individual (i)'s time to travel from county (j) multiplied by 1/3 of individual (i)'s wage rate all

multiplied by two for the return trip home plus \$1 to account for planning and packing. Average wage rate divided by two thousand was used to properly account for opportunity costs of not earning a wage.

$$\text{(Equation 2.4.1) Total_Cost}_{ijk} = 2 * [(\text{variable costs}_k * \text{miles}_{ij}) + (\text{time}_{ij} * (\text{average wage}_i / 2000 * 1/3))] + 1$$

- Sub index - Substitute index is the sum of the indexes of possible reservoir substitutes in a 90 mile radius. The index is created by taking the surface area of substitute (k) divided by miles of individual (i) from county (j).

$$\text{(Equation 2.4.2) Substitute}_i = \sum \text{Sur-Acres}_k / \text{Miles}_{ik}$$

- Population less than 18 is used to account for reservoirs in close proximity to younger age population. This variable is the percent of total population in county (j) minus population over 18 in county over the total population in the county.

2.4.2 Project Variables

Table 12-Lists the proposed Elm Creek Reservoir features needed in the RRDM. From the Sunflower H2O Initiative Water Supply and Demand Study, identification of Potential Surface Water and Groundwater Sources provided by C.H. Guernsey & Company, Oklahoma City assumptions were made about the reservoir features that would affect recreation demand.

- Sur-acres describe the surface area in acres of the proposed reservoir covers at normal pool. Assumptions were made from what was found in the Sunflower H2O initiative Water Supply and Demand Study, Identification of Potential Surface Water and Groundwater Sources study. Water Supply and Demand study identified the maximum pool surface area cover to be 1,895 acres. From this given amount an assumption for the normal operating pool would be approximately 1,800 acres.
- Lanes variable is the number of boat lanes located at the proposed reservoir, also called boat ramps or boat launches. Most boat launch sites are actually two lanes. Ten lanes were assumed in this estimate which means five launching sites with two lanes at each site.
- Beaches variable consist of the number of swimming areas with proper access and infrastructure to accommodate the swimming activity. Well maintained beaches with clean adequate sand could count as two beaches in this variable.
- Marinas variable stands for every 150 permanent boat slips. A marina with 300 slips would count as two. A significant number of private slips could also count as one. Eventually there could be a constraint on this variable to account for capacity issues. More on the discussion of capacity constraint in section 2.5-Model Constraints.
- Docks usually complement boat launching areas. This

sur_acres	1800
Lanes	10
Beaches	3
Marinas	2
Docks	5
Parking	300
Picnic	50
Camps	200
CV	11.28
TDS	311
pct_full	95

Table 12 - Proposed Reservoir Features

variable accounts for those that complement a boat launching area as well as any other public fishing docks. Heated public fishing docks could count for 1.5 in this variable. Docks were assumed to be 5 public docks to complement the 5 boat launching sites.

- Parking variable is a count of the parking spaces which complement the swimming beaches, boat launching sites and camping locations. 300 parking spaces were assumed for this exercise.
- Picnic tables provide around the site. 50 picnic tables were assumed.
- Camps variable accounts for camping sites provided. 200 camping sites were assumed. Camping site is a count of all primitive camping sites. Non-primitive sites can be counted as 1.5 sites for management purposes.
- The coefficient of variation (CV) for monthly average surface area during the recreation season. Analysis assumed the average value of the observed recreation sites in Little Rock.
- Total dissolved solids (TDS) input was 311 which is the average of the six sites sampled in the C.H. Guernsey & Company, Oklahoma City, Water Supply Investigation.
- Pct_full is the percent of the time that 1,800 acres are covered by the lake. 1,800 acres is assumed to be the target acres with lake level target of 1,584 feet above sea level. Lake level provides a better understanding of this variables effect. It can be described as percent of the time that the lake level is at 1,584 feet above sea level. Since lake level and acres covered are related, it is acceptable to make this concept connection.

2.5-Model Constraints

Model constraints describe areas where a model may estimate something that is physically impossible. Example: Region A in a similar TCM study estimated -10,000 visitors. Under most circumstances a negative visitation for a certain zone is physically impossible and thus should be excluded from the final estimate. The RRDM is made of two regression models; the first is a regression model to estimate the day use visitation, the other is a camping visitation model used to estimate the visitation to the camping sites. Both the day-use and camping models have instances where common sense constraints apply.

2.5.1 Day use Model

Day use model: The assumption states that day visitors will not drive more than an hour to a lake site. The negative coefficient on travel cost and substitute index does a good job of providing an upper bound on the model in most circumstances. Larger reservoirs typically have a great diversity of amenities. More amenities at a location could explain a longer distance constraint assumption; however, the smaller the reservoir and the lower the amount of amenity diversity, the lower this distance assumption would be. The substitute variable, described above in Table 11, of all other reservoir index over their distance could also be used to assist in a judgment call for such an assumption. The Eighty mile distance is a safe assumption for such a constraint since more evidence exists where people enjoy secluded nature amenities of distant reservoirs relative to large population centers; also vehicle transportation has become easier and less expensive.

2.5.2 Camping Model

The camping model takes the effects of the demographic variables and project variable assuming that the reservoir infrastructure could accommodate all users. A constraint on the camping model must capture the capacity concern. An example of the effects of the camping model overestimating is when a model predicts 120,000 campers a year which would require more than 250 camp sites (200 camping days X 250 camp sites X the average family size 2.3) could only accommodate 115,000 campers. Under the current scenario of 200 camping sites the model constraint has an upper bound of 92,000 camping visitors annually; the model currently predicts approximately 55,000 camping visitors which is well below this upper constraint. Table 13 shows a range of possibilities from (70-474) camp sites provided at similar reservoirs. A reservation system similar to the Kansas Department of Wildlife, Parks and Tourism’s would help ensure a near capacity level as much as possible⁵.

Table 13 - Similar # of Camp Sites

Substitute Reservoirs	surface area/acre	2010 Visitation	Camp sites
Great Salt Plains, OK	25,660	198,860*	159
Canton Lake, OK	7,910	769,139*	342
Kaw Reservoir, OK	16,750	216,631*	305
Fort Supply Lake, OK	1,820	302,175*	135
Wilson Lake, KS	9,100	232,562*	474
Marion Lake, KS	6,210	402,032*	206
Kanopolis Lake, KS	3,400	277,086*	378
Fall River Lake, KS	2,800	141,894*	240
Toronto Lake, KS	2,350	138,213*	70
Arcadia, OK	1,820	619,623*	188
John Martin, CO	20,515	197,509*	213

Source: * USACE

2.5.3 Other Facilities Constraints

Marina constraint could exist. The number of possible marinas in section 2.4.2 assumes that crowding effect of boat owners do not exist. Research on boat capacity at Eufaula Lake shows peoples’ boating experience can be affected by crowding. The reservoir recreational carrying capacity is unique to the location and users preference. Lakes traditionally considered a fishing lake could have a much lower preferred recreational carrying capacity than a lake considered to be primarily a boating lake. Ecological and aesthetic values of the lake as well as a preferred recreational carrying capacity could be captured in a boater survey. Optimum recreational carrying capacities can range anywhere from five boats per acre to thirty boats per acre. (Doshi 2010) The assumption of two marinas does not take this crowding effect into account; further analysis could be done, after construction, to assess the capacity at the proposed reservoir.

⁵ KDWP; Camping reservation system. <http://kdwpt.state.ks.us/State-Parks/Reservations>

2.5.4 Seasonality

Seasonality typically describes the effect on recreation demand based on the temperature and the change of season. Traditional water based recreation starts an upward trend in March, peaking in June, before falling back off at the end of September. Most of the recreational day visitors and camping visitors will contribute the bulk of their visits in this time frame. Most often lake managers will close parks in the off season to lower the costs of maintenance and gate attendees. As part of the model constraints camping days were assumed to be 200 camping days for the seasonality consideration. If lake managers discovered a large groups’ interest in non-typical season camping, a camping day constraint could be modified. Visitation seasonality at Kaw Reservoir OK was extracted to display how seasonality of visitation would exist. Kaw Reservoir’s visitation seasonality distribution was extracted as a simple example; in reality visitation seasonality might resemble that of a number of other reservoirs. This percentage of total visitation was then distributed on Elm Creek Reservoir estimation of 282,391 to get an estimated seasonality for Elm Creek Reservoir site as Shown in Table 14.

Table 14 - Visitation Seasonality

Kaw Reservoir Visitation Seasonality Applied to Elm Creek Reservoir Estimate											
Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
8%	4%	2%	4%	3%	4%	8%	13%	20%	16%	10%	9%
21,912	10,097	6,715	10,965	8,088	11,831	23,457	37,373	55,573	43,784	27,734	24,863

2.6-Uniqueness Variable

Unique characteristics of lakes and reservoirs are not captured in a generic model such as RRDM. Considerations for unique attributes, characteristics, or activities need to be taken into account in a qualitative form. Examples of unique items can be found in Table 15.

Table 15 - Unique Demand Contributions

Attributes	Characteristics	Activities
Quality fishing experience	Water Quality	Sailing
Unique species fish and wildlife	Aesthetics	Guided fishing
Conference center/State park	Remote and undisturbed	Snorkeling
	Annual festival	Bird and wildlife watching

Conversation with the Sunflower H2O coalition indicated that sailing would be an activity at this lake. In this case, the capacity of the marina (150 slips) multiplied by the average U.S household (2.3) given that they take 14 trips a year (Outdoor Foundation 2010) could produce an extra 5,000 – 6,000 visitors. The largest contribution from this user group is its addition to consumer surplus and regional expenditures. Expenditure effect can be found in Section 3.2 Regional Impact Analysis. Consumer surplus studies will typically label such activities as unique and attach a different value to them. For example; sail boat activity is considered a specialized recreation experience with the Unit Day Value (UDV) of \$44.21 (USACE 2012).

2.6.1 Medicine Lodge Peace Treaty Festival

To estimate the outcome of specialized events such as the Medicine Lodge Peace Treaty Festival, several USACE reservoirs were observed during holiday weekends or specialized events. USACE reservoir observations showed a 150% visitation influx above the typical seasonal influx. Monthly user day visitation estimates around 25,000 for the month of September at Elm Creek Reservoir site (see Table 16). The festival has the potential to increase visitation to Elm Creek Reservoir to 62,500 in the month of September in years of the festival. A camping influx would also be possible, however refer back to section 2.5 Model Constraints for camping capacity issues.

Chapter 3 – Benefits and Future Conditions

3.1-Benefits Measure Methodologies

Consumer surplus is the typical measurement of benefits for outdoor recreation. USACE guidance Section 8 Benefits evaluation Procedures: Recreation of the Economic and Environmental Principles and Guidelines for Water and Related Land Resources stipulates the use of Contingent Valuation Method (CVM) for reservoirs with visitation over 750,000 annually (U.S. Water Resources Council. 1983). For reservoir under this threshold the use of Unit Day Value (UDV) published yearly by USACE-headquarters is appropriate. The use of either method to estimate consumer surplus is acceptable and categorized as National Economic Development (NED). For 2012, the UDV is \$11.17, multiplied by visitation estimate of 282,391 provides the estimate of \$3,154,309 in annual benefits to local consumers of the resource. The value is what was described as consumer surplus, the value individuals obtain, not their expenditures. In TCM consumers will only pay up to or less than what they experience as full value. Once the cost is reached they will stop visiting. Major flaws persist with the UDV rudimentary analysis; first \$11.17 is a general value for all the United States, but people are different across the nation. Second, the UDV assumes little differences in substitution options across the nation where equestrian trails are more prevalent in the mid-west. Third, the UDV is the value of a general recreation visit not a recreation visit at the Elm Creek Reservoir site. The full UDV applies to those facilities which are top of the line including flush toilets, a number of electric camp sites, nice docks and no overcrowding. UDV methodology requires managers to rate their facilities on a point scale basis. This methodology is susceptible to subjectivity in determining the value of the individual recreation value. New facilities would likely apply to these characteristics and obtain the entire value, however loss could persist early. This scale is also a great tool for decision makers to analyze whether or not to update/maintain nice facilities or experience loss of consumer value as well as decreased visitation. Location specific research is recommended to lessen the error in using this value estimate. Survey methods including Contingent Valuation Method (CVM) and Willingness to Pay (WTP) are available to obtain the users value of their recreation experience (Hausman 1994). An exit study of this kind is easier done after construction of the reservoir when the exact recreation users and recreation users residing location are apparent.

Possible Benefits Measure Methodologies

- UDV-consistent with Principals and Guidelines
- TCM- Continuation of RRDM
- Willingness to Pay (WTP) and/or CVM survey (Hausman 1994)

3.2-Regional Impact Analysis

Impact analysis is a type of analysis which tracks the dollars spent by large activities through the local economy. Impact analysis is categorized as the Regional Economic Development (RED) effect as compared to the previous discussion on consumer surplus which is the National Economic Development (NED) effect. In this account, the dollars spent on construction and the dollars spent by induced

recreation visitation could be tracked through the Medicine Lodge region to show the effects on jobs, income, and tax revenue. Spending patterns by activity have been well studied and documented (Chang 2008). These spending patterns could estimate how much visitors spend in the local region when they come to recreate. USACE currently tracks these patterns for all its lakes. Information can be found at the Value to the Nation website⁶. Models for input analysis such as IMPLAN are available for purchase (Minnesota IMPLAN Group, Inc. 1999). Through an input-output (I-O) matrix IMPLAN assists in the multiplicative effects of the spending in the local economy. Regional multipliers can be created for each account; jobs, income, and tax revenue or a full analysis can be created using a social accounting matrix (SAM) to further track regional expenditures into induced households spending.

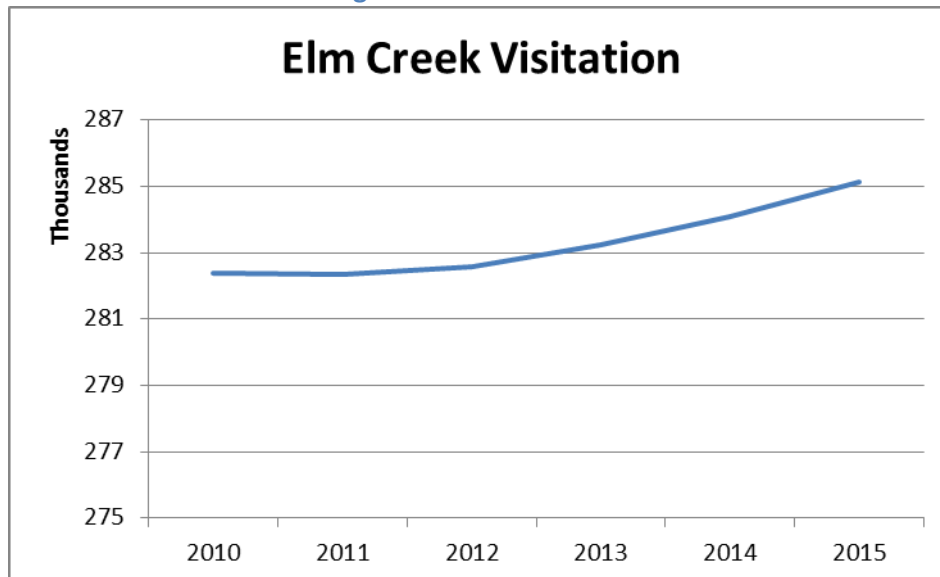
3.3-Forecast

Forecasts of these results were developed to account for the age of the data used in the model. Census data from 2012 was not used in the original estimate to address the possible error created in the American Community Surveys (ACS). A percent change forecasting method from 2000 to 2010 was used to forecast into 2015. Results of the forecast can be found in Table 16 and the trend is displayed in Figure 6.

Table 16 - Visitation Forecast

	2010	2011	2012	2013	2014	2015
Day use	227,107	227,214	227,589	228,459	229,541	230,836
Camping	55,284	55,134	54,996	54,759	54,531	54,311
All visitors	282,391	282,348	282,585	283,218	284,072	285,147

Figure 6 - Visitation Trend



⁶ USACE; Value to the Nation website. www.valuetonation.com

In Zone 1 and 2 the populations are forecasted to shrink, however the growth in Zone 3 will more than account for this loss. In fact visitation could increase by a rate range of .1%-2%. This forecast becomes unreliable for very many years out past 2015. A forecast out to 2020 was performed for the camping model alone to see when 200 camping site might become a capacity constraint. Camper visitation forecasted a slight drop to 53,500 campers using these facilities by 2020, still below the capacity limit. An alternative forecast was performed under the assumption that population and per capita income growths would resemble that of the State of Kansas .6% and 2% respectively. In this scenario camping visitation approaches close to 65,000 by 2020. As stated before, this forecast is unreliable; however, it shows initial facility requirements for the next five years. Seasonality and cyclical factors usually exist in forecasting methods; however these forecasts are data intensive and are best established from primary data. Cyclical factors such as the festival held every three years in September will likely have a significant impact. New or temporary camp sites could be created every festival year to accommodate this influx of visitors.

3.4-Risk and Uncertainty

3.4.1 Risk

Risk-based analysis is used to compare plans in terms of the likelihood and variability of their physical performance, economic success and residual risks. The total effect of risk and uncertainty on the project's design and viability can be examined and conscious decisions made reflecting an explicit trade-off between risk and costs. Risk discussions in water resource management typically consist of flood damage, coastal storm damage, the loss of structure integrity, ecosystem habitat loss and potential harm to or loss of life. In the topic of recreation, unforeseen risk includes the possibility of water related accidents and over constructing resulting in wasting scarce infrastructure capital. Risk also applies to some level of probability that the model and forecasts for recreation do not materialize. In this instance under engineering has a lower probability risk and lower economic consequences than over engineering as related to recreational facilities construction. Over engineering, building too many recreation facilities and expecting a higher visitation, can result in capital lost and unused infrastructure. Under engineering, expecting too few visitors creates loss of value due to the crowding out effect. This means that more must be built in the off season between peak recreation seasons. An adaptive management method will provide the least risky outcome. Adaptive management consists of adjusting expected visitation throughout the years and acting accordingly.

3.4.2 Uncertainty

Uncertainty addresses the limitations of model prediction values due to the model's variables, collection methodologies, and correlations between variables. Some risk of error circumstances have been addressed throughout the model and forecast sections (i.e. the R^2 value) but are provided here as a summary. Model risk error or uncertainty areas can be found in the Census data used. The Census data error ranges for population and income have a triangular distribution. Triangular distributions mean that there is a likely mean number as well as a minimum and maximum. Without more insight to the variable changes a minimum/maximum sensitivity analysis can provide an interval of a likely range of estimates

(see next section). Facility variables in the model have the possibility of undocumented correlation between variable. As seen in stated demand preference for a boat launching lane has correlation with demand for courtesy docks. This correlation is documented and minimized in the RRDM creation and user manual. (Ward 1995) Data collect and model variables may not properly represent the ever changing trends in recreation behavior. An example of this is when a wildlife viewer (growing recreation type) is not documented in their day use. Some recreation users such as wildlife viewers are not required to pay day fees and thus are not documented or counted as a visitor. Forecasting methods areas of uncertainty can be found in the period of record. The period of record could be too short for the desired forecast, it can also be a misrepresentation of the future it is asked to predict. This forecast's period of record is insufficient for a longer forecasted period and should only be considered a straight line forecast without any cyclical or trend adjustments.

3.4.3 Sensitivity Analysis

Sensitivity analysis was constructed with the standard error found in the Census data for the variables of population, income, and percent population under eighteen for the twenty three county region. This analysis resulted in an interval of {263,966 – 301,862} visitors to be the most likely, given the 95% confidence interval variation in the census variables. Further variations remain unexplained in the variables of total travel costs and substitute index. Note: if the upper end of this interval is more realistic to the decision makers, then the camping capacity constraint will exceed 200 needed camping sites earlier than 2020. Other areas of sensitivity and variability such as dry year effect on lake levels, and total dissolved solid, sensitivity were considered. Both scenarios are discussed in the next chapter.

Chapter 4 – Management and Marketing

4.1-Management Practices

4.1.1 Lake Level

One important management action for reservoir operators is lake level fluctuations. Lake capacity can have trade-off tensions placed on it for regional water supply purpose, irrigation, drought or even flood risk management. Management of the resource could have significant implication on recreation visitation. Empirical evidence shows a connection between lake level and visitation (Badger 1975). The RRDM used here has estimation on the effect of lake level variation through the variables of CV and percent full; the theory behind this estimation is that the aesthetic value is lost for some users while other users decide to not participate. This effect is exemplified when extreme lake level reduction renders the water is inaccessible. Most boat ramps cannot safely allow use after a 15 foot drop in the lake level. Management practices and drought contingency plans can reduce the effects of a naturally occurring drought. In a dry year scenario, an assumption that the lake was only capable of maintaining a 75% full average for the year was used. This scenario resulted in 212,000 visitors being the likely mean outcome and a loss of 74,500 visitors or 25% loss when the reservoir lake level was not maintained to the baseline assumption of 95% full average.

4.1.2 Nutrient and TDS

Blue –green algae blooms could have a significant effect on recreation visitation as shown at Marion Lake, Kansas. Marion Lake experiences drastic blue-green algae blooms. The State of Kansas typically has safe levels of blue-green algae, but when these levels are exceeded it can cause site shutdown and warnings. Total Dissolved Solids (TDS) also have an effect on recreation. The assumption in the baseline estimate was 311 TDS, found from an average of all sites measured by C.H. Guernsey & Company, Oklahoma City in the Sunflower H2O Initiative Water Supply and Demand Study, Identification of Potential Surface and Groundwater Sources. In a scenario where TDS is assumed to be 400 approximately 1,500 fewer visitors are estimated.

4.1.3 Location and Access

While there are recreation user groups who prefer secluded rough terrain, the majority of the recreation user groups prefer accessible developed recreation activities. Location off Highway 281 along the western bank of proposed Elm Creek Reservoir is ideal for private development to provide those amenities such as hotels, motels, conference centers, golf courses, restaurants, beaches, swimming areas and marinas. With proper management of the development locations on Elm Creek Reservoir, it could serve both user groups by keeping the eastern shore secluded and rural rough terrain providing those amenities such as cabins, hiking trails, equestrian trails outdoor classrooms and public hunting on the eastern shore. More and more research has identified a compounding effect with providing multiple activities at outdoor recreation sites. The term “fun for the whole family” is more than just a marketing scheme. Families make recreation decisions based on the need to please all in the family group.

4.2-Marketing-User Groups

4.2.1 User Groups by Location

This section defines the preliminary user groups by location. Identifying user groups and where they originate from will assist with any marketing initiative. Many more successful marketing initiatives could be successful, this simple provides a starting place.

- Wichita
- Pratt and Alva
- Interstate 54
- Interstate 35

4.2.2 User Groups by Activity

The second half of this section categorizes user groups based on activities as opposed to location. The typical categorizations are day users without a boat, day user with a boat, campers without a boat, and campers with a boat. This categorization is preferred to define the spending patterns of groups (Chang 2008). For this exercise users are categorized by activity to better the management of the infrastructure needs of those activities. A single user could belong to many groups however the best practice to attract certain users is to focus on their primary activity. Categories based on this are:

- Hunter/Fisherman
- Primitive campers
- Swimmers
- Hikers
- Equestrian Trail users
- Recreation Vehicle (RV) site users
- House boaters
- Sailors
- Conferences
- Off road recreational vehicle riding
- Boaters
- Bird and Wildlife watchers

As discussed before in section 4.1.3 Location and Access many users prefer solitude for their activity. Also some activities produce externalities such as noise that would be undesirable to other activity users. Lake managers should consider these overlaps when targeting an activity to attract. A shoreline management plan and zoning should be implemented to limit the overlaps as much as possible. To target some of these groups there are preliminary infrastructure needs for users.

- Hunters/Fisherman-Practices which could attract hunters and fisherman could include a seasonal pool to assist in the fish spawning process or even a fish stocking program. (See Kansas Department of Wildlife, Parks and Tourism (KDWPT) <http://www.kdwpt.state.ks.us/>.) A seasonal pool could also assist the hunters by providing areas to plant mill and winter crops to attract wildlife. Fishermen also need the typical two or three lane boat ramp. In the event that a large fishing tournament takes place, users would need one boat ramp site with two sets of ramps, an ADA compliant boat ramp, a fish weighing area, restrooms (shared with a camping site area), two courtesy docks and ample parking. Ideal sites to launch fishing tournaments have a large cove where fisherman could wait until their number is called.
- Primitive Camper- Primitive campers are some of the easiest and least capital intensive groups to attract. A centralized restroom and water for every 10-20 sites could be all that is required to fill camp sites.

- Swimmers- Some beaches can be capital and maintenance intensive requiring cleaning and re-filling each year. As discussed earlier location selection can help limit some maintenance needs. Other than the construction and maintenance a beach would only require parking and restrooms/water. The restrooms/ water could be shared with a close-by camping area.
- Hikers- Hikers and cross-country runners require very little capital and maintenance; however they could require a large space. Local hikers and cross-country running groups may volunteer to maintain and build their own trail if only given the space and permit. Biking trail groups typically share this same characteristic of self volunteering.
- Equestrian trail user- Equestrian trails are considered low impact however heavily used trails could have a landscape impact.
- Recreational vehicle (RV) site user- RV sites require about twice the space as primitive campers. Also they require bigger roads, bigger turning areas and bigger parking spaces than the primitive users as well as dump site facilities.
- House boater- House boater would require a protective cove for the construction of marinas/slips. Partnerships with private groups could provide the required capital for a marina. House boaters desire water quality and clarity when making their purchasing decision. House boat users also desire additional anchoring sites located throughout the lake. These sites typically consist of large commercial sunken anchors attached to a buoy which houseboats can attach to and be securely anchored for an overnight excursion.
- Recreational Sailor- Sailors are relatively low impact to other types of users. The only real impact is the boat crowding and capacity issue.
- Conferences- Conference facility users spending patterns have a higher regional purchasing coefficient. More trip expenditures are captured within the region by other indirect beneficiaries.
- Off road recreation vehicles- Off road vehicles have the typical externalities of noise and environmental impacts on the landscape.

4.2.3 User Group by Demographic Indicator

This section discusses the users activities which can be targeted based on demographic information

- Younger age groups such as those found in Alva, Oklahoma could provide the opportunity for a successful marketing campaign. Infrastructure opportunities such as ample swimming beaches could assist a marketing campaign targeting youth users.
- Identifying high median age group can be an equally successful marketing strategy. High median age and income groups traditionally favor fishing tournaments as well as marinas.
- Lower income groups traditionally recreate less, however efforts to provide public fishing docks and bank fishing areas could provide the opportunity to increase typical visitation numbers from this socio-demographic group. (Hall 2009)

4.3-Standards

When designing boat launch facilities or ramps USACE develops its' designs in accordance with engineering manual (EM 1110-1-400) *Engineering and Design* and engineering regulation (ER 1110-2-400) *Design of Recreation Sites Areas and Facilities*. These standards ensure that the facilities are Americans Disability Act (ADA) compliant as well as structurally compliant and sufficient for the typical lake level fluctuations.

4.4-Water Based Amenities

Beaches and swimming areas can attract day users. The quality of the swimming beaches depends on the maintenance of the beach sand, cleanliness and water quality. Selecting the proper location for the beaches to lessen the water surges from the major body of the lake can be the best strategy. Also selection of a location with a gradual slope is preferred.

Summary

The preliminary recreation analysis estimates {263,966 – 301,862} visitors annually with approximately 282,391 being the most likely value. The nearby Medicine Lodge Peace Treaty Festival could contribute one and a half times the monthly average during months in which the festival was held. The camping sites will likely be at or near capacity during the festival for any number of camping sites however on an annual basis two hundred camp sites would likely be sufficient for current demand. In the not too distance future 200 camp sites could prove to be insufficient to satisfy all demand. Lake managers would need to implement adaptive management techniques after the construction of the original 200 camping sites.

Cross-country RV owners using I-35 and I-54 could contribute significant visitation number if properly marketed to. The "Get Outdoors" initiative adopted by Kansas in their 2009 SCORP which identifies a need for opportunities for inner city youth to get outdoors could be partially met with the creation of Elm Creek Reservoir. The Kansas SCORP identifies demand for amenities such as: shared hard surface trails, playground equipment, open space, free ride area, shared use soft surface trails, hiking trails, waterfront and equestrian trails which could all be provided at the Elm Creek Reservoir site.

Further valuation techniques are available to better display the effects on recreation users' consumer surplus and the regional economic impact of the construction and operation of the Elm Creek Reservoir site. A survey including questions on the users' intrinsic value of the resource, their spending patterns, their recreational carrying capacity and development preference could be administered to evaluate the full impacts of the Elm Creek Reservoir site.

The Elm Creek Reservoir site has the potential to serve a significant portion of this regional outdoor recreation demand. Elm Creek Reservoir's size, proximity to Wichita, Kansas, accessibility and triennial festival held in the nearby town of Medicine Lodge, Kansas could contribute to a successful recreation opportunity.

References

- Badger, D.D., & Harper, W.M. (1975). *Assessment of Pool Elevation Effects on Recreation and Concession Operations at Tenkiller Ferry Lake*. Prepared for U.S. Army Corps of Engineers Tulsa District, Department of Agricultural Economics, Oklahoma State University.
- Chang W., Propst D. B., Stynes D. J., & Jackson S. R., (2003), *Recreation Management Support Program, Recreation Visitor Spending Profiles and Economic Benefit to Corps of Engineers Projects*. (Environmental Laboratory ERDC/EL TR-03-21). Prepared for the United States Army Corps of Engineers.
- Cordell, H. K., Betz, C., Bowker, J. M., English, D. B., Mou, S. H., Bergstrom, J. C., ... Loomis, (1999). *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends*. Champaign, IL: Sagamore Publishing.
- Diamond P. A. & Hausman J. A. (1994), Contingent Valuation: Is Some Number Better Than No Number? *The Journal of Economic Perspectives*, 8 (4), 45-64.
- Doshi, S. (2010), *Recreational Carrying Capacity in Lakes*. Indiana Clean Lakes Program (Factsheet 10-02).
- Dwyer, J. F. (1994) *Customer Diversity and the Future Demand for Outdoor Recreation* (General Technical Report RM-252). Fort Collins Co: Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Hall T. E., Heather H., & Kruger L. E., (2009). *Outdoor Recreation in the Pacific Northwest and Alaska: Trends in Activity Participation*. Prepared for the United States Forest Service.
- Kansas Department of Wildlife Parks and Tourism. (2007). *Recreation Finder* [Data file]. Retrieved from <http://maps.kansasgis.org/recfinder/public/index.cfm>
- Kansas Department of Wildlife Parks and Tourism. (2009) *State Comprehensive Outdoor Recreation Plan*. Topeka, KS; Retrieved from <http://www.kdwpt.state.ks.us/news/State-Parks/S.C.O.R.P>

Minnesota IMPLAN Group, Inc. (1999). *IMPLAN Professional Version 2.0: User's Guide*, Minnesota
IMPLAN Group, Inc, Stillwater, MN.

United States Army Corps Engineers. (2011) *Value to the Nation* [Data file]. Retrieved from
<http://www.corpsresults.us/recreation/>

United States Army Corps of Engineers. (2012), *Unit Day Values for Recreation for Fiscal Year 2012*.
(Economic Guidance Memorandum, 12-03). Washington D.C.

United States Census Bureau. (2010). *American Fact Finder* [Data file]. Retrieved from
<http://factfinder2.census.gov/>

United States Water Resources Council. (1983). *Economic and Environmental Principles and Guidelines
for Water and Related Land Resources Implementation Studies*. Washington, DC: U.S.
Government Printing Office.

Ward, F. A. *Regional Recreation Demand Model for Large Reservoirs : User's Guide and Model for
Documentation, version 1.0* (Instruction report ; R-95-1). Prepared for U.S. Army Corps of
Engineers ; monitored by U.S. Army Engineer Waterways Experiment Station.