

Sediment Loads to John Redmond Reservoir by Contributing Area

Review of Data from KDHE Stream Chemistry Sampling Program in Project Study Area

Introduction

John Redmond Reservoir is located in Coffey County in east-central Kansas. The John Redmond Feasibility Study Area (Figure 1) includes portions of nine counties in Kansas and is described as that portion of the John Redmond Reservoir drainage area below Marion and Council Grove Reservoirs. This is an area of approximately 2,537 square miles.

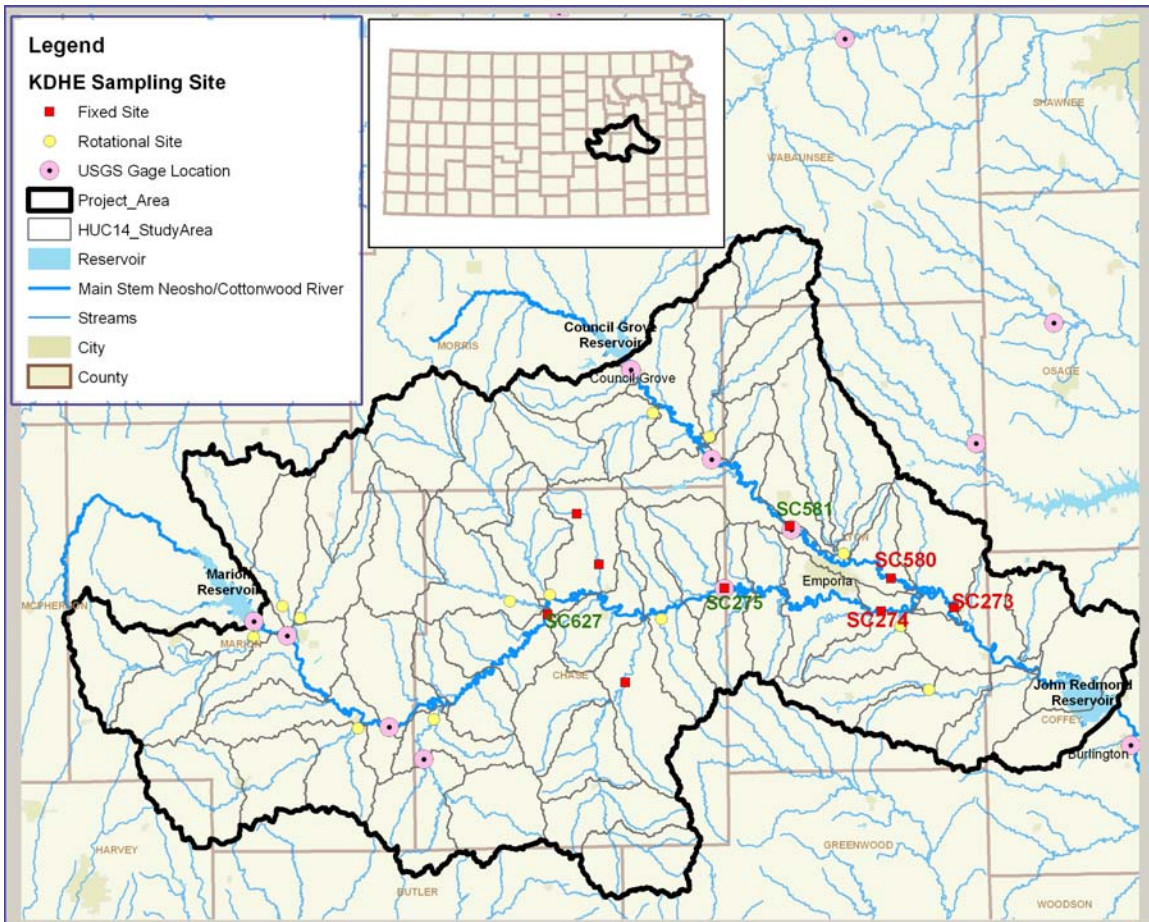


Figure 1: John Redmond Study Area

There are 22 active Kansas Department of Health and Environment (KDHE) stream chemistry sampling locations within the project study area. There are two types of sampling sites shown in Figure 1; the red squares are fixed sites which are sampled every other month every year and the yellow circles are rotational sites which are sampled every other month every fourth year. Almost 1,300 ‘grab’ samples have been collected at these sampling locations since 1985.

This review uses Total Suspended Solids (TSS) concentrations from concurrent grab samples collected at many of the KDHE stream chemistry sampling locations in the John

Redmond study area along the main stem of the Neosho and Cottonwood Rivers. The TSS data is assumed to represent the sediment concentration in those ‘grab’ samples and this sediment concentration is converted to sediment load for the flow at that sampling location as scaled from the recorded flow at a nearby USGS gage for the day the ‘grab’ sample was collected. Since the KDHE has been monitoring TSS for such a long period of time, the ‘grab’ samples have covered essentially every flow condition experienced in the watershed.

Following the same general method that Kansas has developed for Total Maximum Daily Load establishment, sediment loads are plotted as a load exceedence curve. From this point a third-degree polynomial is fit to each of these sediment load curves for each of the sampling sites used for the comparison. This establishes a general relationship for a sampling site on the stream/river between sediment load and flow conditions. From this, comparisons can be made about the relative magnitude of sediment load contributions between upstream and downstream sampling sites.

The first comparison is for stream chemistry sampling sites SC273, SC274 and SC580 (Figure 2) to determine the relative sediment load contribution to SC273, located on the main stem of the Neosho River downstream of its confluence with the Cottonwood River, from the Neosho River and Cottonwood River branches above it.

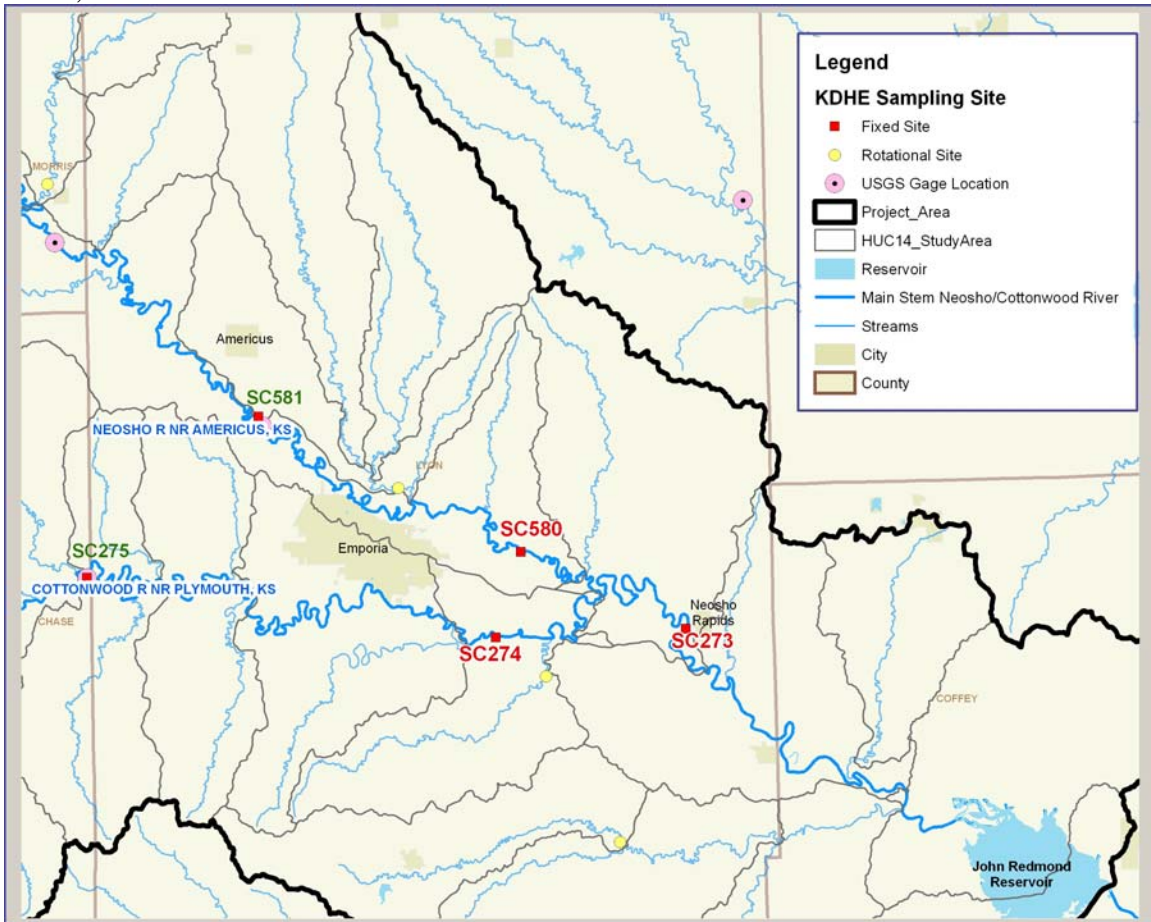


Figure 2: Sediment loads comparison for confluence of Cottonwood and Neosho Rivers (Sites 273, 580 and 274).

Figure 3 displays the sediment load data from each of the sampling locations and a third-degree polynomial fit to those data. The green markers and green fitted line are for the data collected at sampling site 273 and the blue and yellow markers and fitted lines are for the two contributing sites located above site 273 (sites 274 and 580, respectively). From Figure 3, most of the sediment load by mass at site 273 is from site 274, the Cottonwood River. Comparisons are made on the fitted lines and represent general relationships.

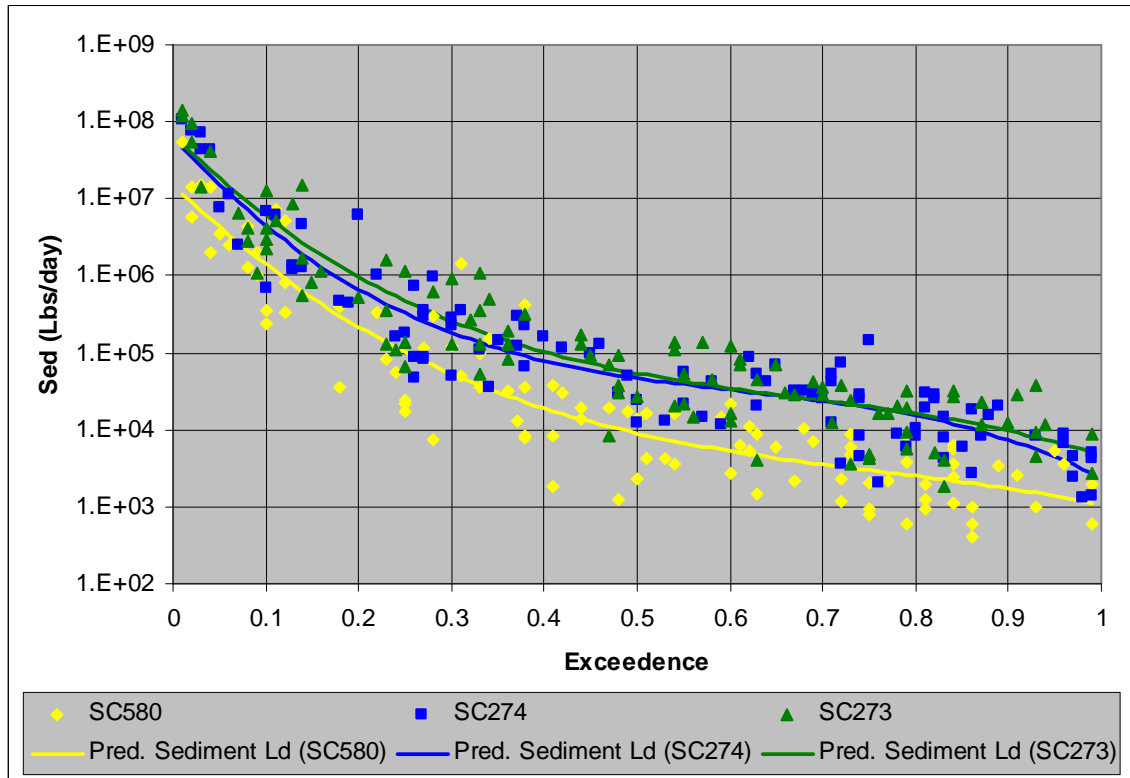


Figure 3: Sediment load comparison for stream chemistry sites 273, 274 and 580.

On average across all flow conditions about 81% of the sediment load at site 273 is from the Cottonwood River and about 19% is from the Neosho above the confluence with the Cottonwood River. Figure 4 shows the relative contribution by flow exceedence as expressed as percent of load at site 273 from the two upstream sources. For flows exceeded less than 10% of the time (higher flows), about 78% of the sediment load is from the Cottonwood River and about 22% is from the Neosho River.

However, when drainage areas for each reach are factored in (Cottonwood River drainage area is about 1,677 sq mi and the Neosho River at its confluence with the Cottonwood River is about 511 sq. mi) the rate of sediment load contributed per square mile is about the same from each branch. If one takes into account the number of stream miles (from the Kansas Surface Water Register) in each drainage area, the rate of sediment loading per stream mile reach is also about the same for each branch.

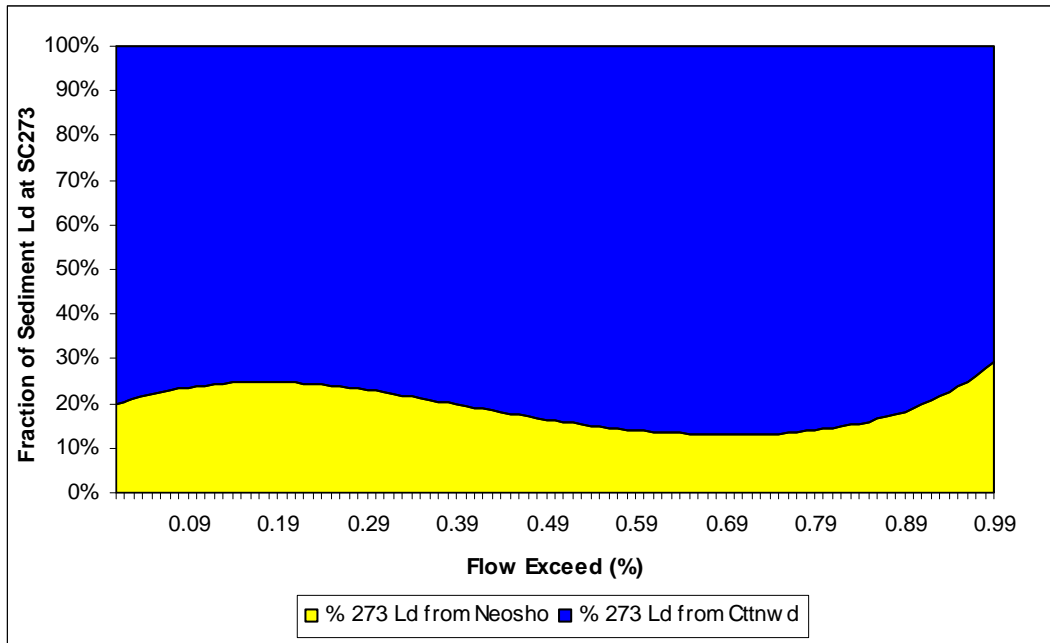


Figure 4: Percent of load at site 273 from Cottonwood and Neosho Rivers

Flows are much larger/higher in the Cottonwood River than in the Neosho River above the confluence of the two. Under lower to medium-low flow conditions, the Neosho River branch above site 273 actually transports a larger sediment load than the Cottonwood River branch. Under medium to higher flows the Cottonwood branch transports a larger sediment load than the Neosho River branch (Figure 5).

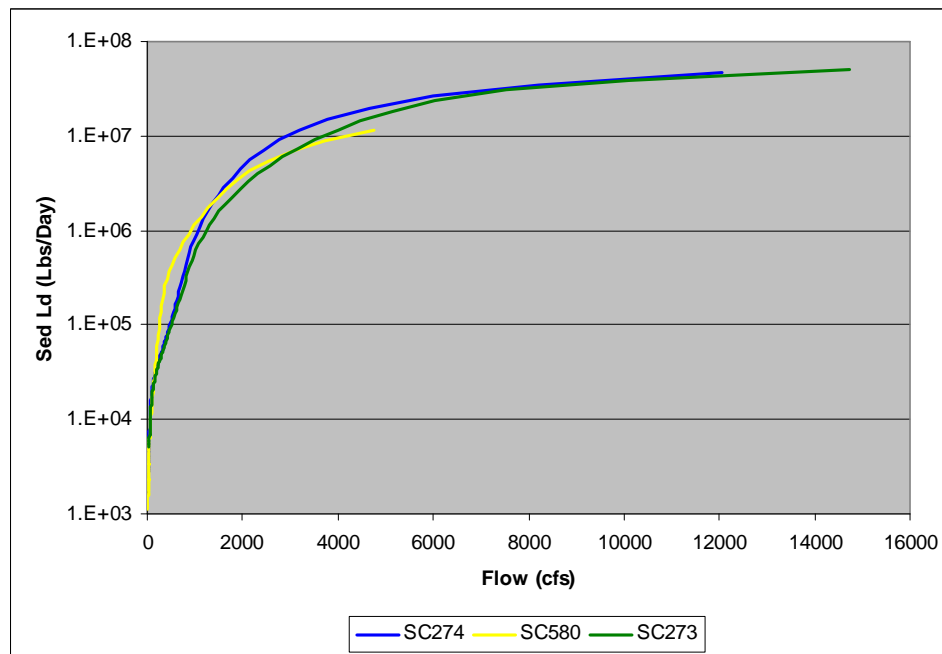


Figure 5: Estimated sediment load by flow

Neosho River Branch above Cottonwood River Confluence

The next comparison is on the Neosho River above its confluence with the Cottonwood River. In this comparison site 580's sediment load is evaluated by the sediment load at the next sampling site upstream on the Neosho River, site 581 (Figure 6; sites of interest are labeled as red text).

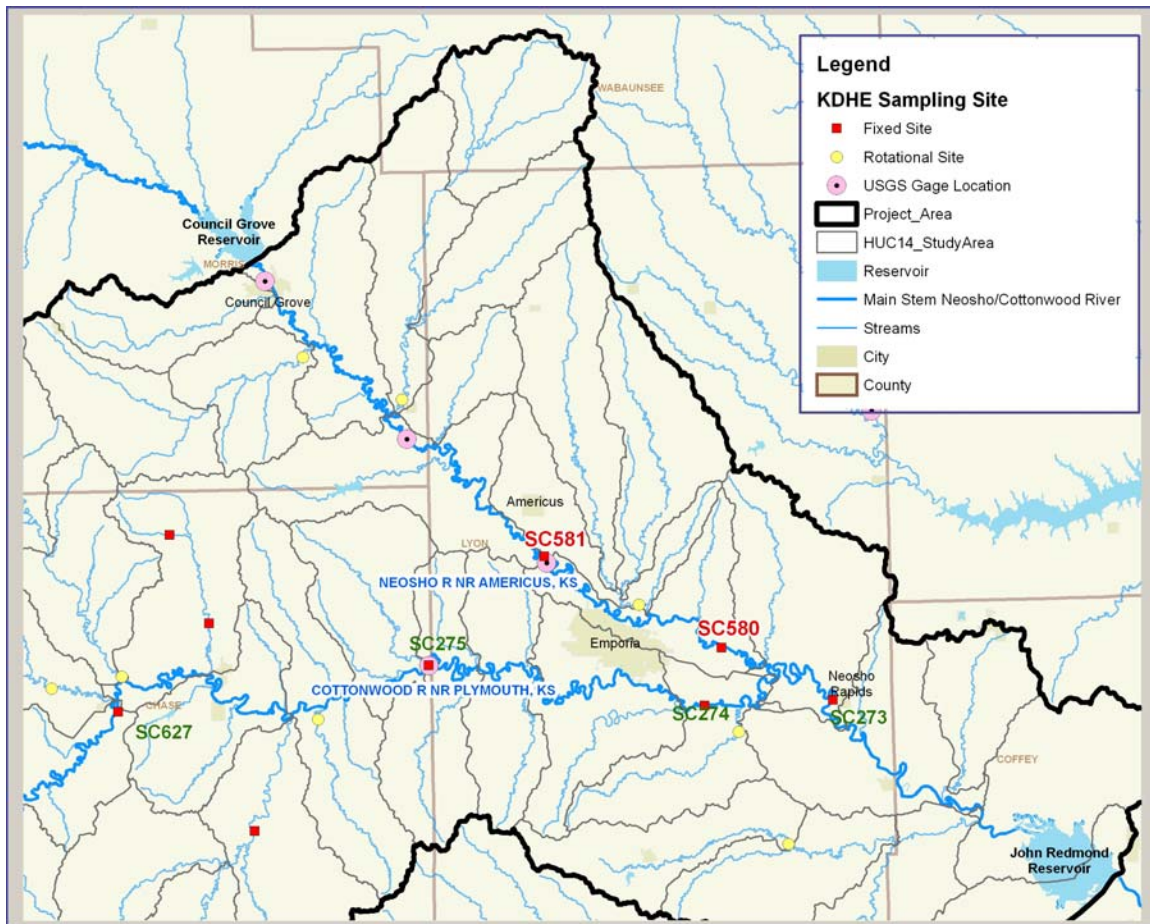


Figure 6: Sediment load comparison for Neosho River (Sites 580 and 581)

Figure 7 displays the sediment load data from each of the sampling locations and a third-degree polynomial fit to those data. The yellow markers and yellow fitted line are for the data collected at sampling site 580 and the red markers and fitted line are for the contributing site located above site 580 (site 581). Comparisons are made on the fitted lines and represent general relationships between flow conditions and sediment fluxes at each location.

The relationship between flow exceedence and sediment load at site 581 represents the percent of the sediment load at the downstream site (580) contributed from the drainage area above site 581. The difference in the sediment loads at the two sites represents the sediment load contributed from the drainage area between sites 581 and 580. Figure 8 displays the percent of the sediment load at site 580 contributed from site 581. The

difference between the two is assumed to have been gained from the drainage between the two sites.

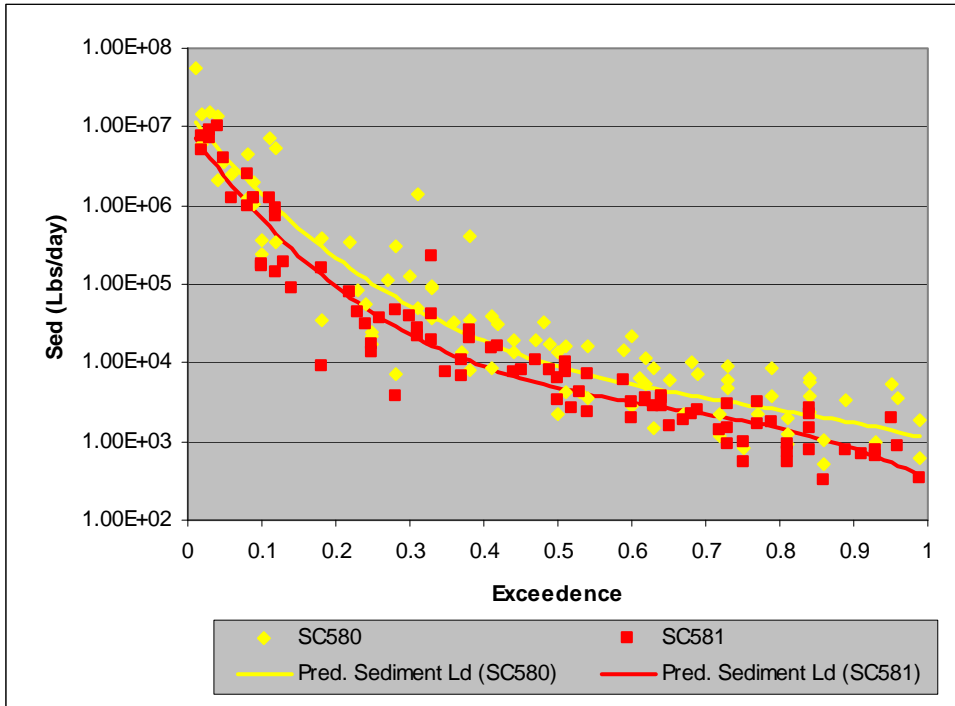


Figure 7: Sediment load comparison for stream chemistry sites 580 and 581.

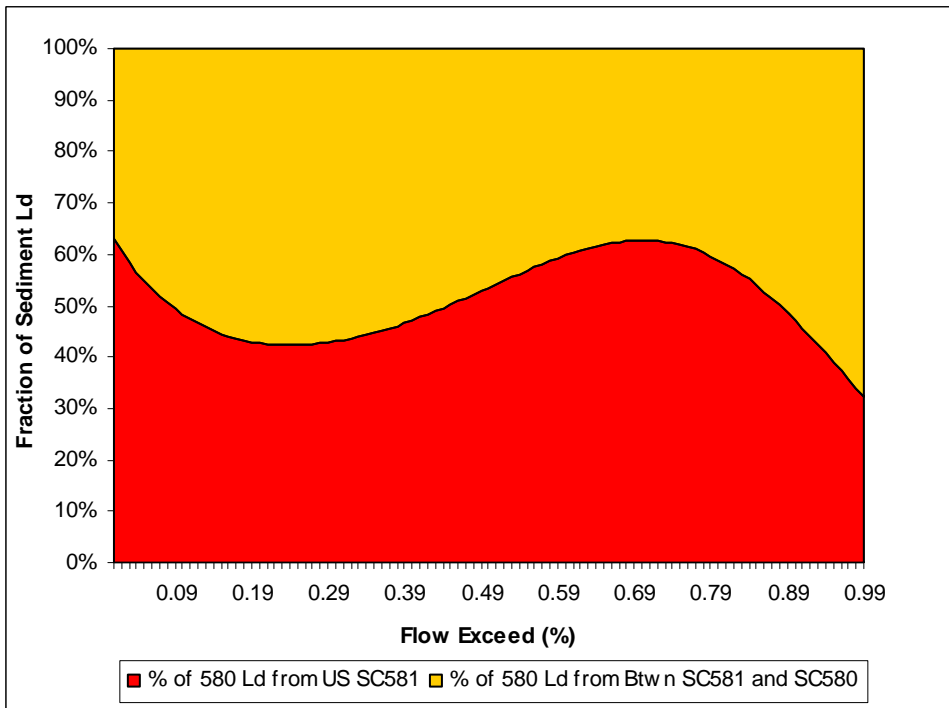


Figure 8: Percent of sediment load at site 580 from upstream of site 581 and downstream of site 581 by flow condition.

On average across all flow conditions about 51% of the sediment load at site 580 is from upstream of site 581 and about 49% is from downstream of site 581. For flows exceeded less than 10% of the time (higher flows), about 55% of the sediment load at site 580 is from upstream of site 581 and 45% is from downstream of site 581.

However, when drainage areas for each reach are factored in (drainage area above site 581 is about 355 square miles and drainage area below site 581 and above site 580 is about 161 square miles) the rate of sediment load contributed per square mile below site 581 is a bit more than twice the rate contributed from above site 581. If one takes into account the number of stream miles (from the Kansas Surface Water Register) in each drainage area above and below site 581, the rate of sediment loading per stream mile reach downstream of site 581 is also more than twice the rate as above site 581.

This difference in sediment loading rate down stream of site 581 (and above 580) would define the area for enhanced riparian condition assessment on the Neosho River above its confluence with the Cottonwood River. Figure 9 shows the HUC14s associated with this drainage area of interest below site 581 outlined in red; the comparison area is outlined green in Figure 9.



Figure 9: Watershed with greatest sediment flux on the Neosho River above its confluence with the Cottonwood River.

A quick comparison between this drainage area and the one located upstream of site 581 shows differences that may be possible land surface sources for the higher sediment flux below site 581 (and above 580). In the drainage of interest one possible source of sediment would be urban runoff from the cities of Emporia and Americus. Land use differences also exist between the two watersheds which may explain some of the difference in sediment flux to the sampling sites on the Neosho River. Table 1 shows the area and the percent of the total watershed that each land use comprises for each of comparison drainage areas. The area of greater sediment flux (below Site 581) has a larger percent of its area in urban land use, cropland, and disturb land and a smaller percent in grassland.

Land Use	Watershed Abv Site 581		Watershed Blw Site 581	
	Area (Sq Mile)	% of Area	Area (Sq Mile)	% of Area
<i>Woodland</i>	32.8	9.24	18.2	11.32
<i>Cropland</i>	49.2	13.84	47.0	29.17
<i>Grassland</i>	242.7	68.30	64.9	40.28
<i>Disturbed Land (Ag)</i>	26.1	7.35	25.9	16.06
<i>Marsh</i>	0.6	0.17	0.7	0.45
<i>Urban</i>	1.8	0.50	3.3	2.06
<i>Water</i>	2.1	0.59	1.1	0.65
Total	355.3	100.00	161.2	100.00

Table 1: Land use comparison for drainage areas on Neosho River above confluence with Cottonwood River in relation to sediment flux estimates from Sites 581 and 580

The condition comparison of the riparian areas of the two watersheds could not be assessed due to a lack of (relatively) up-to-date information for that source.

**Cottonwood River Branch above Confluence with Neosho River:
Sampling Sites 274 and 275**

As shown previously, most of the sediment load in the Neosho River, below its confluence with the Cottonwood River, is from the Cottonwood River watershed. However, there was little difference in the loading *rate* by area and stream mile at the confluence of the Neosho and Cottonwood River branch watersheds indicating the primary reason that the Cottonwood’s watershed contributes more sediment load is just a matter of scale. The Cottonwood’s drainage area is proportionately larger and consequently has proportionally greater flow and more stream miles.

The next comparison is on the Cottonwood River above its confluence with the Neosho River. In this comparison, the site 274 sediment load is compared to the sediment load at the next sampling site upstream on the Cottonwood River, site 275 (Figure 10; sites of interest are labeled as red text).

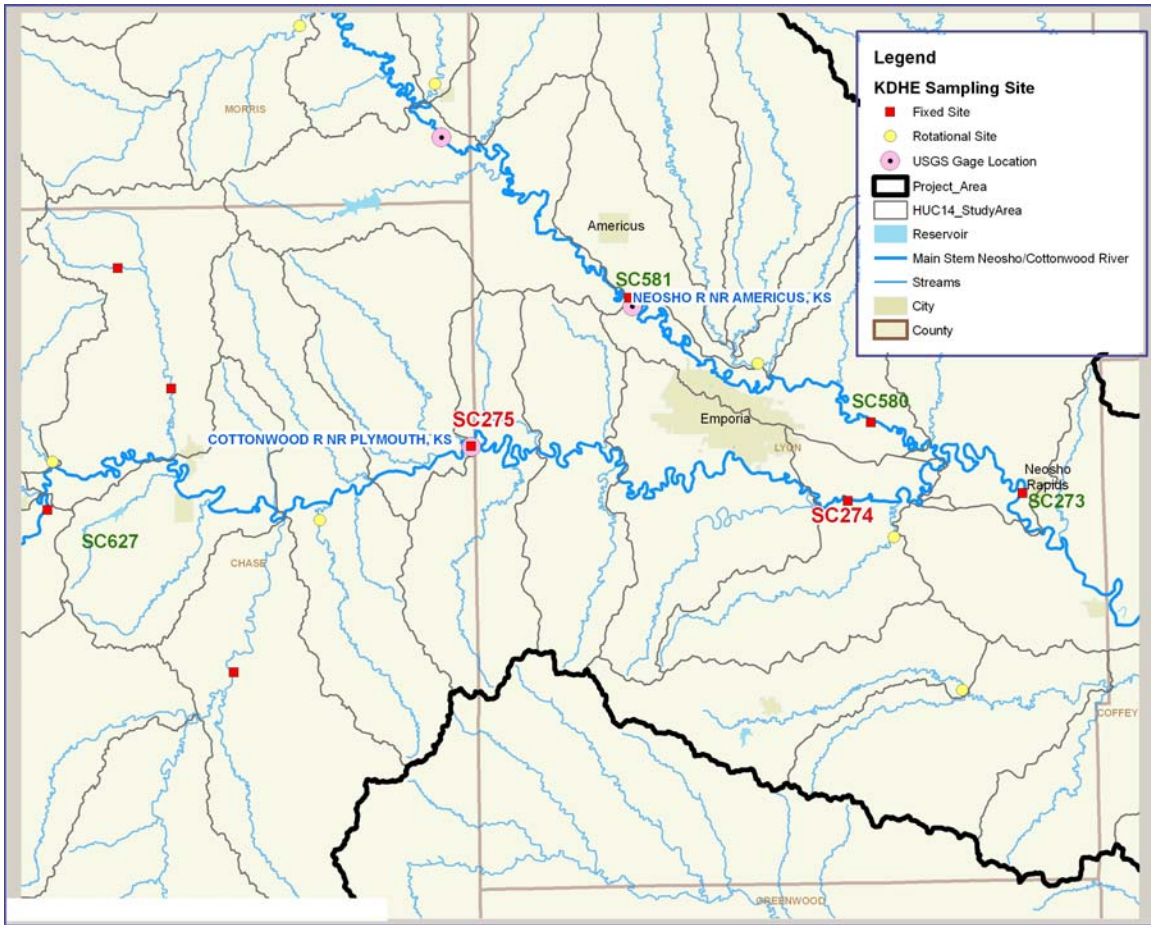


Figure 10: Sediment load comparison for Cottonwood River (Sites 274 and 275)

Figure 11 displays the sediment load data from each of the sampling locations and a third-degree polynomial fit to those data. The blue markers and blue fitted line are for the data collected at sampling site 274 and the orange markers and fitted line are for the contributing site located above site 275. Comparisons are made on the fitted lines and represent general relationships between flow conditions and sediment fluxes at each location.

The relationship between flow exceedence and sediment load at site 275 represents that percent of the sediment load at the downstream site (274) contributed from the drainage area above site 275. The difference in the sediment loads at the two sites represents the sediment load contributed from the drainage area between sites 275 and 274. Figure 12 displays the percent of the sediment load at site 274 contributed from site 275. The difference between the two is assumed to have been gained from the drainage between the two sites.

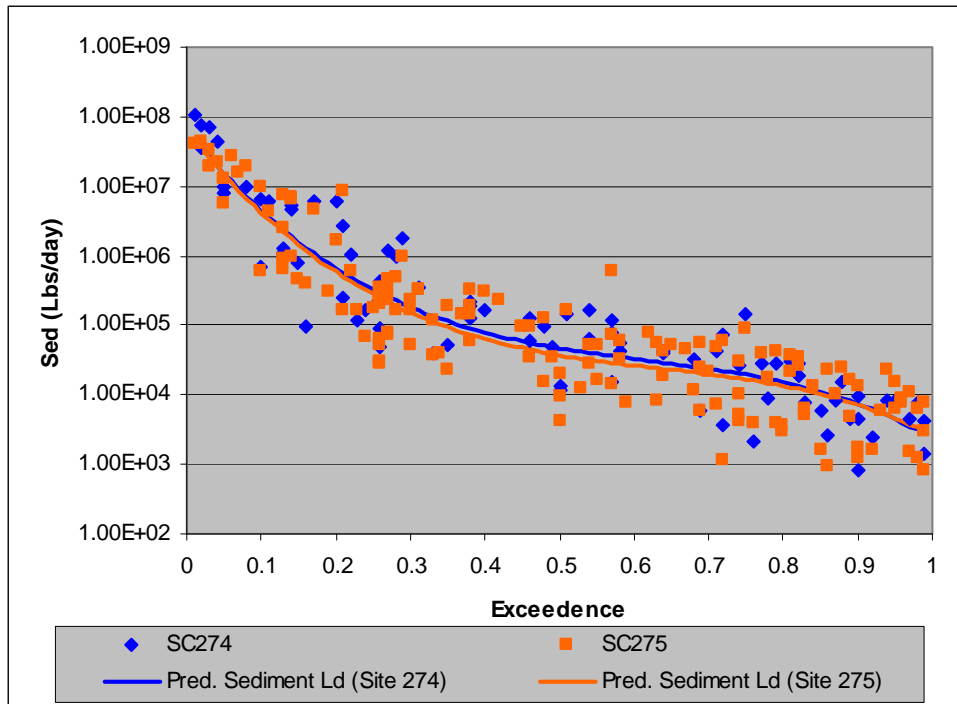


Figure 11: Sediment load comparison for stream chemistry sites 274 and 275.

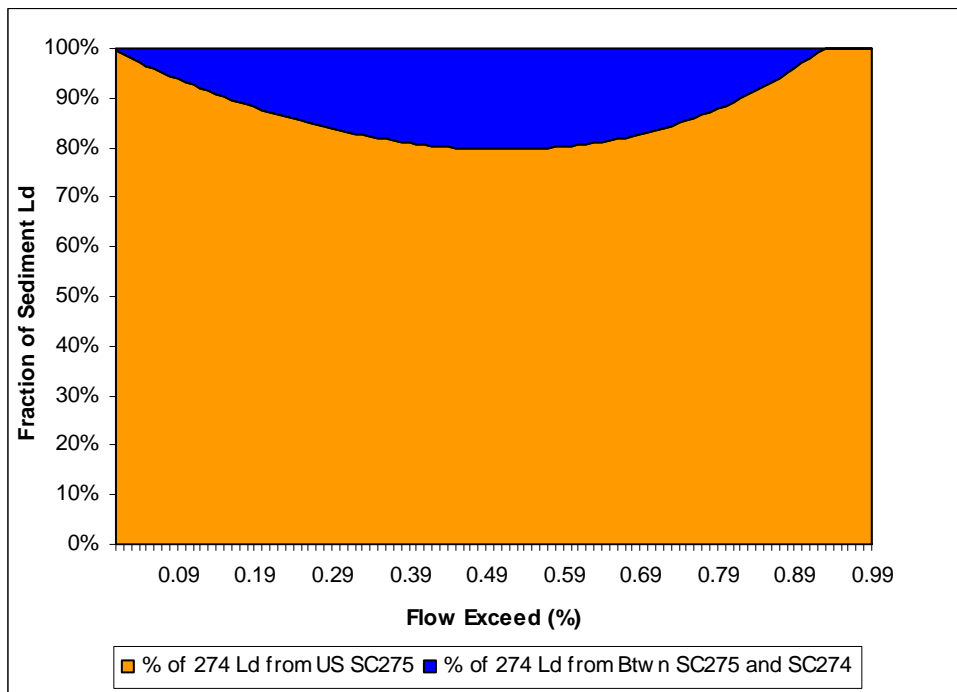


Figure 12: Percent of sediment load at site 274 from upstream of site 275 and downstream of site 275 by flow condition.

On average across all flow conditions about 87% of the sediment load at site 274 is from upstream of site 275 and about 13% is from downstream of site 275. For flows exceeded less than 10% of the time (higher flows), about 96% of the sediment load at site 274 is

from upstream of site 275 and 4% is from downstream of site 275. Since most of the volume of sediment over a longer period of time is transported under only the highest flow conditions, the percent sediment load for the higher flows is probably the best indicator of sediment load contribution.

When drainage areas for each reach are factored in (drainage area above site 275 is about 1,524 square miles and drainage area below site 275 and above site 274 is about 172 square miles) the rate of sediment load contributed per square mile below site 275 is about the same as the drainage area sediment flux above site 275 across all flow conditions. When only the higher flow events are considered, the sediment flux rate below site 275 is about half that above site 275. If one takes into account the number of stream miles (from the Kansas Surface Water Register) in each drainage area above and below site 275, the rate of sediment loading per stream mile reach downstream of site 275 is again about the same rate as above site 275 across all flow conditions and about half the rate for only the high flow conditions.

This difference in sediment loading rate down stream of site 275 (and above 274) helps exclude this drainage area from enhanced assessment. The flux rate is lower from this area than from sources upstream so enhanced assessment should be directed upstream of site 275.

A quick comparison between this drainage area and the one located upstream of site 275 shows few land surface differences that may be possible sources for the lower sediment flux below site 275 (and above 274). In the drainage of interest one contrary source of sediment would be urban runoff from the City of Emporia. Only one land use difference exists between the two watersheds which may explain some of the difference in sediment flux to the sampling sites on the Cottonwood River. Table 2 shows the area and the percent of the total watershed that each land use comprises for each of comparison drainage areas. The area of lower sediment flux (below Site 275) has a larger percent of its area in woodland.

Land Use	Watershed Abv Site 275		Watershed Blw Site 275	
	Area (Sq Mile)	% of Area	Area (Sq Mile)	% of Area
<i>Woodland</i>	82.5	5.42	22.6	13.15
<i>Cropland</i>	487.0	31.96	50.9	29.62
<i>Grassland</i>	900.9	59.12	74.5	43.38
<i>Disturbed Land (Ag)</i>	40.5	2.66	15.5	9.01
<i>Marsh</i>	2.9	0.19	0.4	0.24
<i>Urban</i>	4.6	0.30	6.0	3.50
<i>Water</i>	5.4	0.36	1.9	1.10
Total	1523.8	100.00	171.8	100.00

Table 2: Land use comparison for drainage areas on Cottonwood River above Site 275 in relation to sediment flux estimates from Sites 274 and 275

The riparian conditions above and below site 275 could not be assessed due to a lack of recent riparian source data.

Since there is little difference in land uses below sites 275 (Table 2) on the Cottonwood River, which has a lower sediment flux relative to the area upstream of site 275, and below site 581 (Table 1) on the Neosho River, which has a higher sediment flux relative to the area upstream of site 581, the most likely difference between these two areas would be the riparian condition of both watersheds. The only significant land use difference between the two watersheds is that the area below site 275 on the Cottonwood River has a smaller percent of disturbed land.

**Cottonwood River Branch above Confluence with Neosho River:
Sampling Sites 275 and 627**

The next comparison is on the Cottonwood River above Site 275. In this comparison, the site 275 sediment load is compared to the sediment load at the next sampling site upstream on the Cottonwood River, site 627 (Figure 13; sites of interest are labeled as red text).

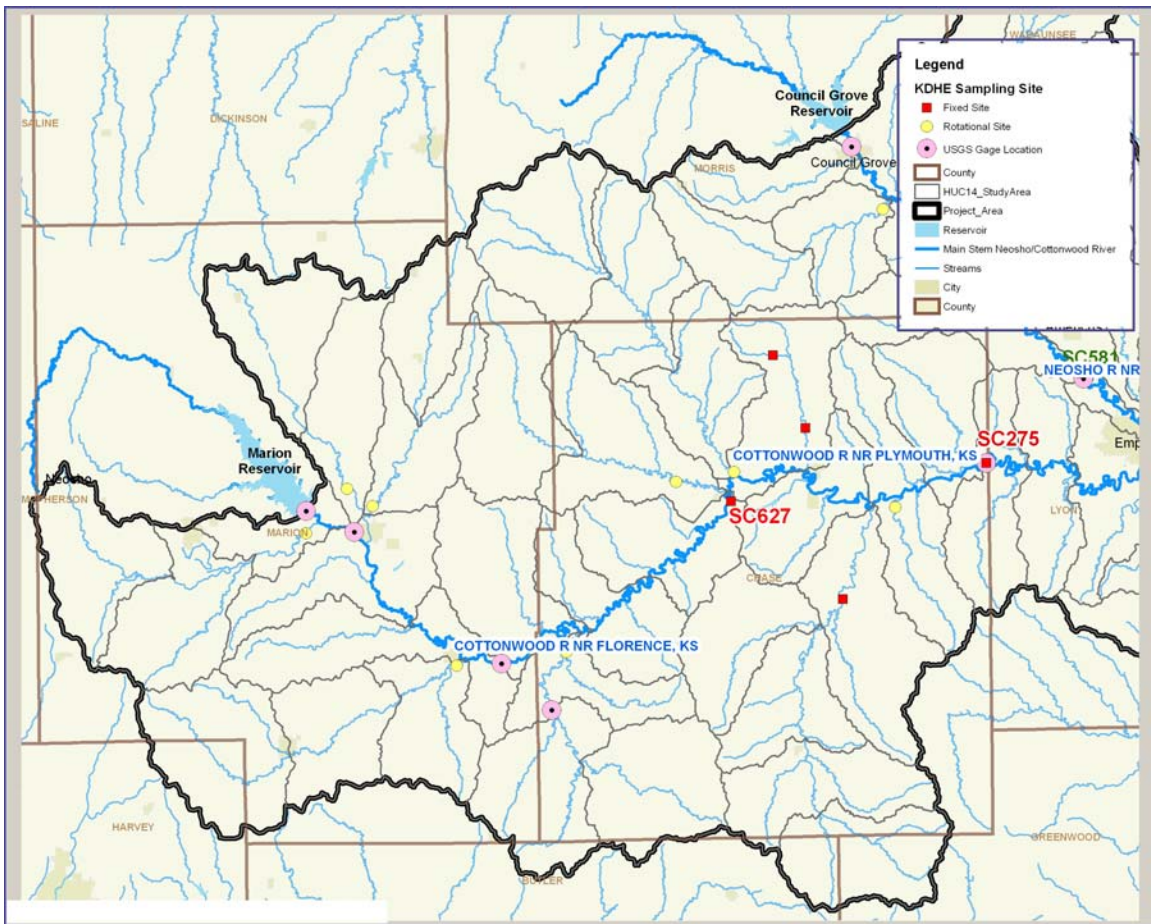


Figure 13: Sediment load comparison for Cottonwood River (Sites 627 and 275)

Figure 14 displays the sediment load data from each of the sampling locations and a third-degree polynomial fit to those data. The orange markers and orange fitted line are for the data collected at sampling site 275 and the purple markers and fitted line are for

the contributing site located above site 627. Comparisons are made on the fitted lines and represent general relationships.

The relationship between flow exceedence and sediment load at site 627 represents that percent of the sediment load at the downstream site (275) contributed from the drainage area above site 627. The difference in the sediment loads at the two sites represents the sediment load contributed from the drainage area between sites 627 and 275. Figure 14 displays the percent of the sediment load at site 275 contributed from site 627. The difference between the two is assumed to have been gained from the drainage between the two sites. The flow data used to estimate the loads for site 627 was proportionately scaled by drainage area to the Cottonwood River nr Florence. The drainage area at site 627 was more comparable in size to the Florence gage location than the Plymouth gage location (Figure 13).

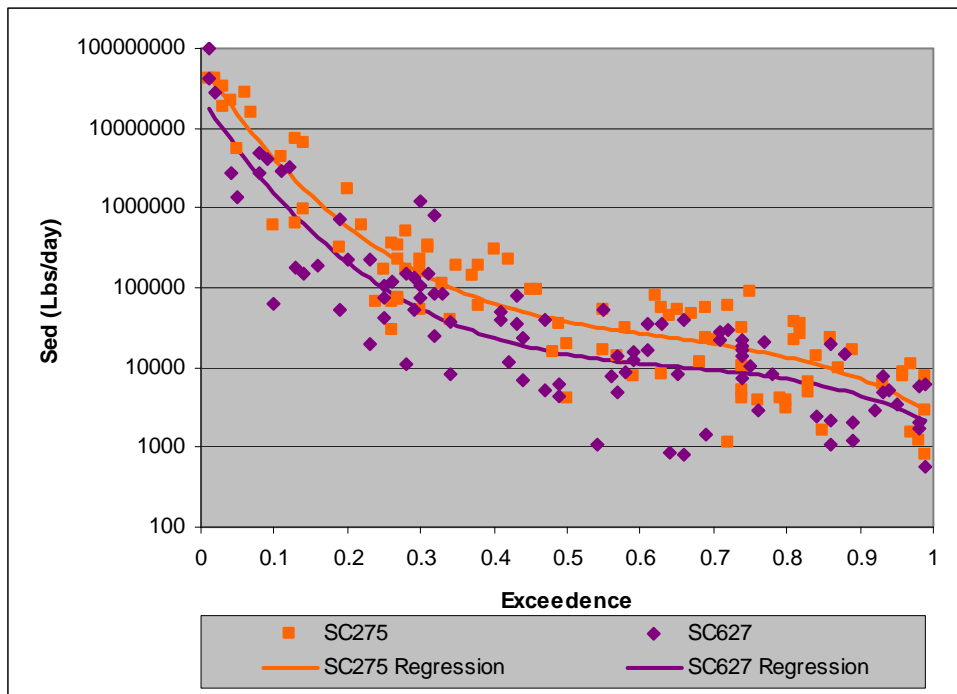


Figure 13: Sediment load comparison for stream chemistry sites 275 and 627.

On average, across all flow conditions about 44% of the sediment load at site 275 is from upstream of site 627 and about 56% is from downstream of site 627. For flows exceeded less than 10% of the time (higher flows), about 37% of the sediment load at site 275 is from upstream of site 627 and 63% is from downstream of site 627. Since most of the volume of sediment over a longer period of time is transported under only the highest flow conditions, the percent sediment load for the higher flows is probably the best indicator of sediment load contribution.

When drainage areas for each reach are factored in (drainage area above site 627 is about 823 square miles and drainage area below site 627 and above site 275 is about 701 square miles) the rate of sediment load contributed per square mile below site 627 is about 1.5 times the rate contributed from above site 627. When only the higher flow events are

considered, the sediment flux rate below site 627 (and above site 275) is about twice the rate above site 627. If one takes into account the number of stream miles (from the Kansas Surface Water Register) in each drainage area above and below site 627, the rate of sediment loading per stream mile reach downstream of site 627 (and above 275) is slightly more than one and a half times the rate as above site 627.

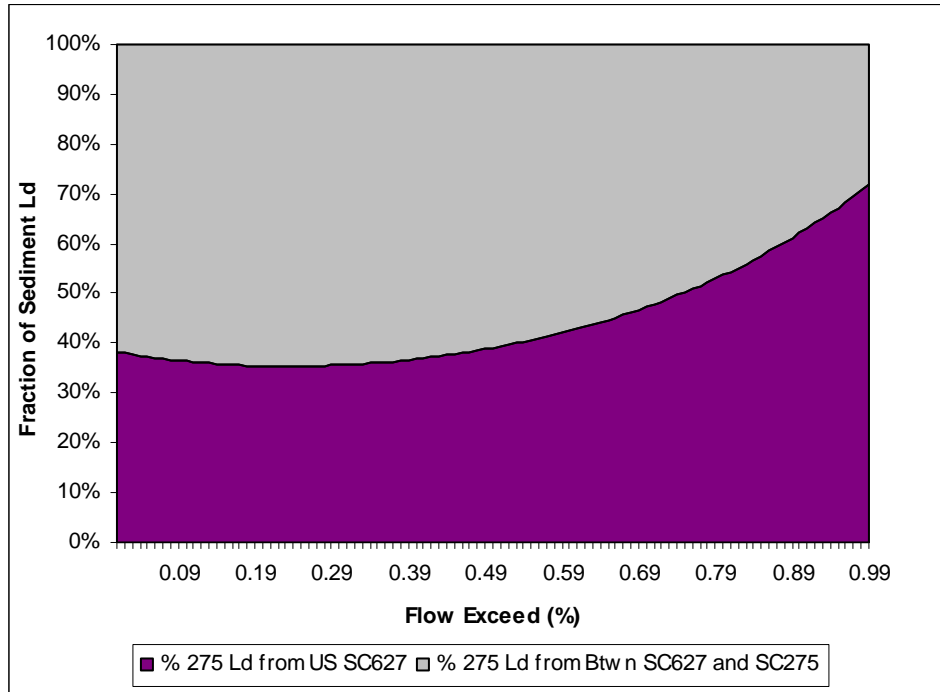


Figure 14: Percent of sediment load at site 275 from upstream of site 627 and downstream of site 627 by flow condition.

This difference in sediment loading rate down stream of site 627 (and above 275) would define the area for enhanced assessment on the Cottonwood River above its confluence with the Cottonwood River. Figure 15 shows the HUC14s associated with this drainage area of interest below site 627 outlined in red; the comparison area is outlined green in Figure 15.

A quick comparison between this drainage area and the one located upstream of site 627 shows few land surface differences that may be possible sources for the higher sediment flux below site 627 (and above 275). Table 3 shows the area and the percent of the total watershed that each land use comprises for each of comparison drainage areas.

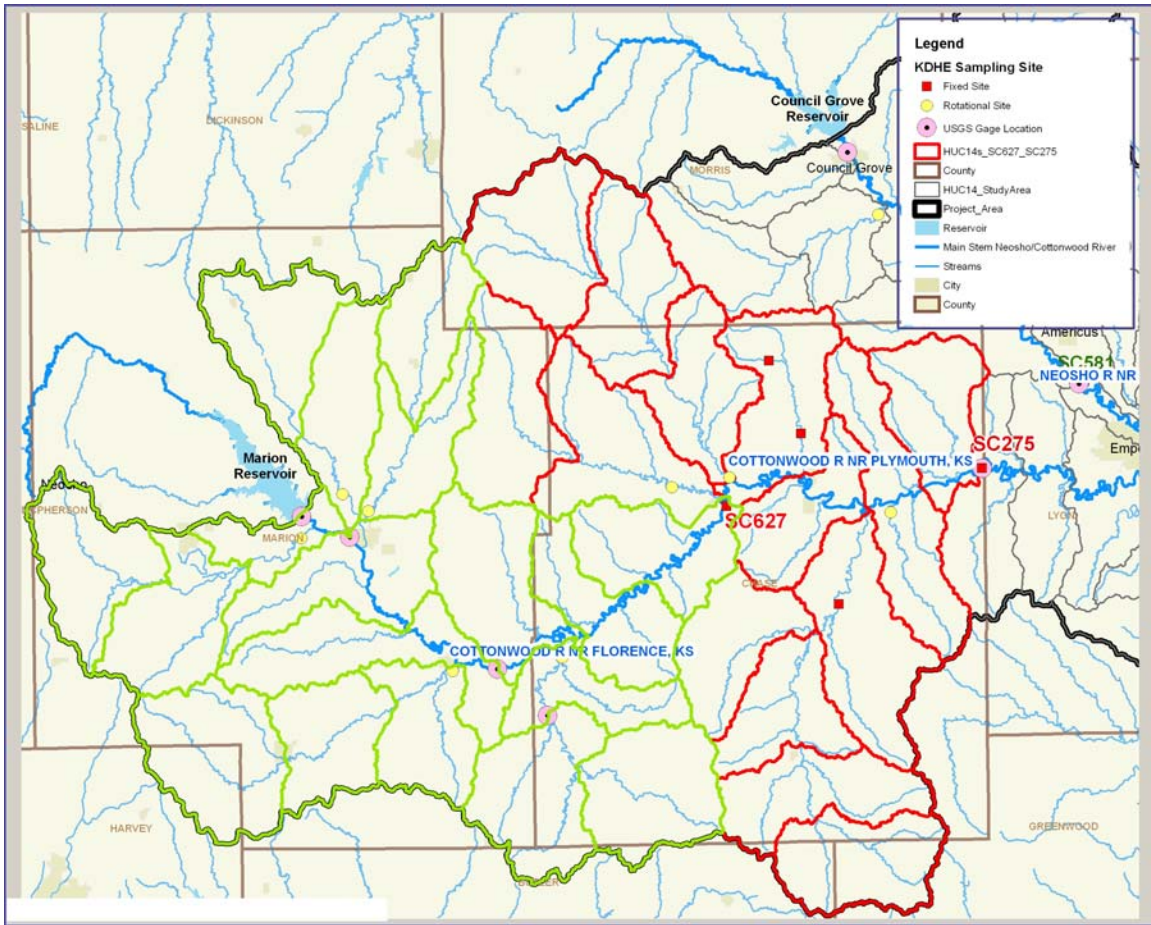


Figure 15: Watershed with greatest sediment flux on the Cottonwood River above its confluence with the Neosho River.

Land Use	Watershed Abv Site 627		Watershed Blw Site 627	
	Area (Sq Mile)	% of Area	Area (Sq Mile)	% of Area
<i>Woodland</i>	42.3	5.14	40.2	5.74
<i>Cropland</i>	394.9	48.00	92.1	13.14
<i>Grassland</i>	360.0	43.76	540.9	77.15
<i>Disturbed Land (Ag)</i>	18.7	2.28	21.8	3.11
<i>Marsh</i>	1.2	0.14	1.7	0.24
<i>Urban</i>	3.4	0.41	1.2	0.17
<i>Water</i>	2.2	0.27	3.2	0.46
Total	822.8	100.00	701.1	100.00

Table 3: Land use comparison for drainage areas on Cottonwood River above Site 627 in relation to sediment flux estimates from between Sites 275 and 627

The riparian conditions above and below site 627 could not be assessed due to a lack of recent riparian source data.

Since the predominance of the types of land use in table 3 would generally indicate that the sediment flux below site 627 (and above site 275) should be less than the watershed above site 627 (comparing the percent grassland and cropland of the two areas), rather than what the sampling data indicate, which is just the opposite, the condition of the

riparian area would be a factor that should be assessed for the contributing area between sites 627 and site 275.

Tributary Unit Flow Review: Neosho Branch Targeted Area for Riparian Assessment

United State Geological Survey Scientific Investigation Report 2004-5033 has estimated, among other flow characteristics, peak discharges for stream segments on the 1999 Kansas surface water register. Assuming that sediment flux is generally related to the flow rate per unit area, we can identify those tributary stream segments within the targeted area on the Neosho River branch (Figure 16) with the greatest likelihood of sediment load contribution.

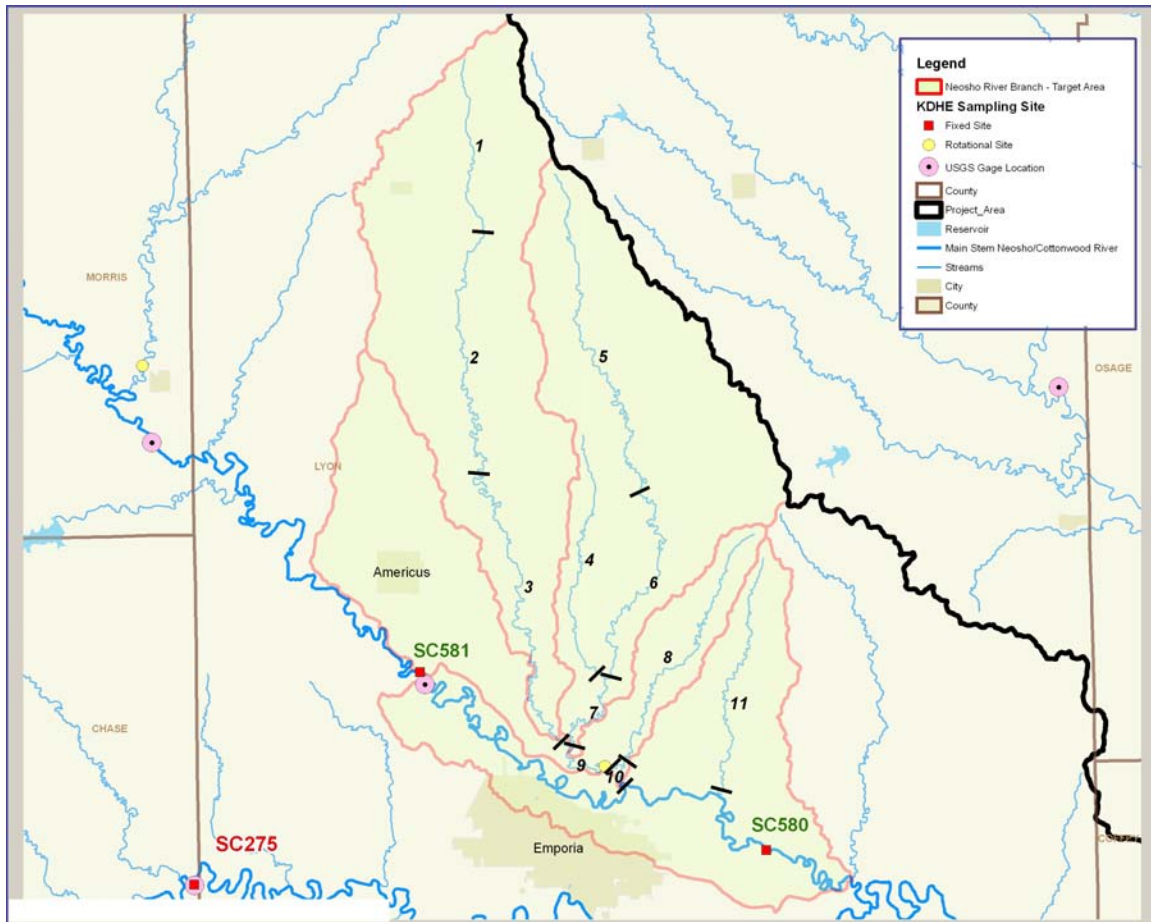


Figure 16: Tributary segments located within the Neosho River sediment target area for riparian assessment

There are five tributaries to the sediment contribution area of interest on the Neosho River branch of the project study area. Those five tributaries as segmented in USGS SIR 2004-5033 are listed in Table 4 along with the flow per unit area for the 2-year estimated peak discharge for the contributing area to each tributary segment. Flows per unit areas for each segment have been adjusted to the area of contribution's incremental gain.

From table 4, those tributary stream segments with the greatest unit flow contribution for the 2-year peak flow are Upper and Middle Allen, Stillman, Upper Dow, Taylor and

Plumb Creeks. Assessment of the riparian condition of these tributaries would initially be directed to these tributaries. Generally, the highest unit yields were from the smaller drainage areas at the upper ends of tributary streams. Included in the initial assessment would also be the main stem of the Neosho River between site 580 and 581 (Figure17).

Tributary Name	Figure 16/17 Segment Reference #	Incremental 2-Yr Peak Flow (cfs)	Incremental Segment Contributing Area (sq mi)	cfs/sq mi
Upper Allen Cr	1	1,300	12.5	104.0
Middle Allen Cr	2	1,900	22.0	86.4
Allen Cr (at Dow Cr confluence)	3	-120	17.0	-7.1
Stillman Cr	4	1,200	10.5	114.3
Upper Dow Cr	5	1,880	23	81.7
Dow Cr (at Stillman Cr confluence)	6	440	8	55.0
Dow Cr (at Allen Cr confluence)	7	320	13	24.6
Taylor Cr (at Allen Cr confluence)	8	1,250	10.4	120.2
Allen Cr (at Taylor Cr confluence)	9	1,400	45	31.1
Allen Cr (at Neosho R confluence)	10	300	10	30.0
Plumb Cr (at Neosho R confluence)	11	1,470	12.6	116.7

Table 4: Tributary stream segment unit flow contribution to Neosho Branch riparian assessment target area

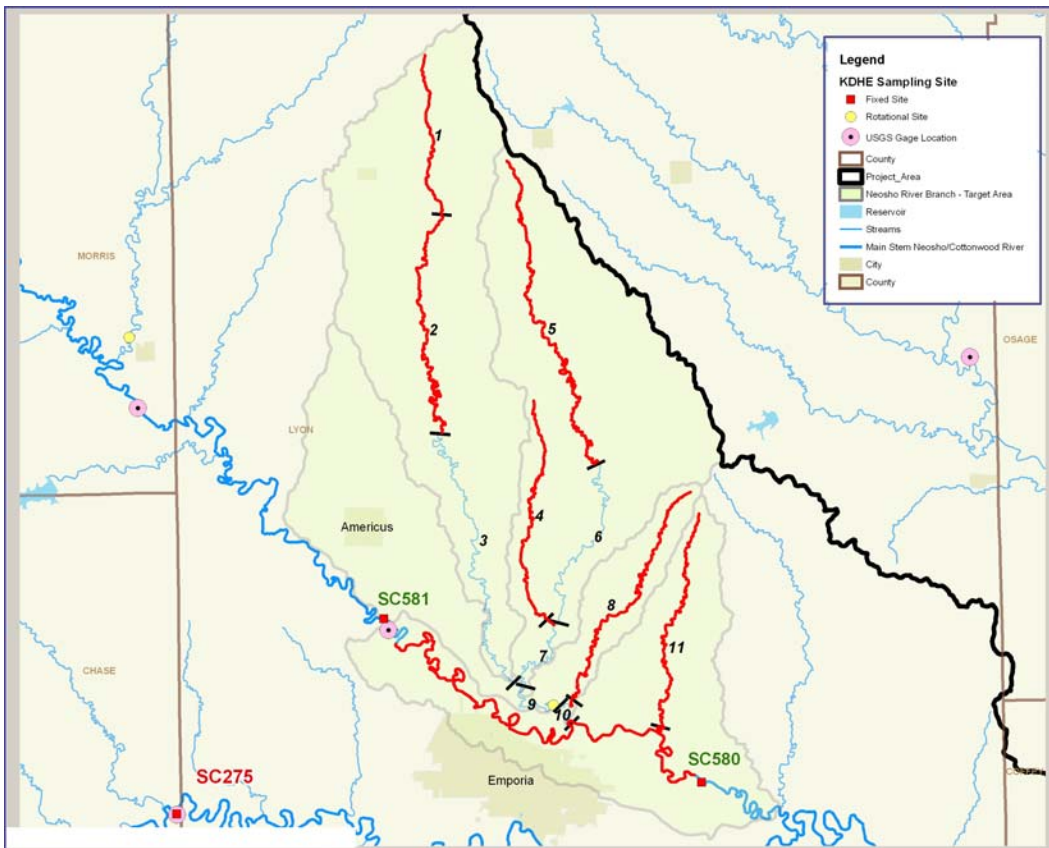


Figure 17: Tributary segments within targeted Neosho River Branch watershed with greatest unit flow contribution

Tributary Unit Flow Review: Cottonwood Branch Targeted Area for Riparian Assessment

Using the same United State Geological Survey Scientific Investigation Report and the method employed on the Neosho River Branch target area, we can also identify those tributary stream segments within the targeted area on the Cottonwood River branch (Figure 18) with the greatest likelihood of sediment load contribution.

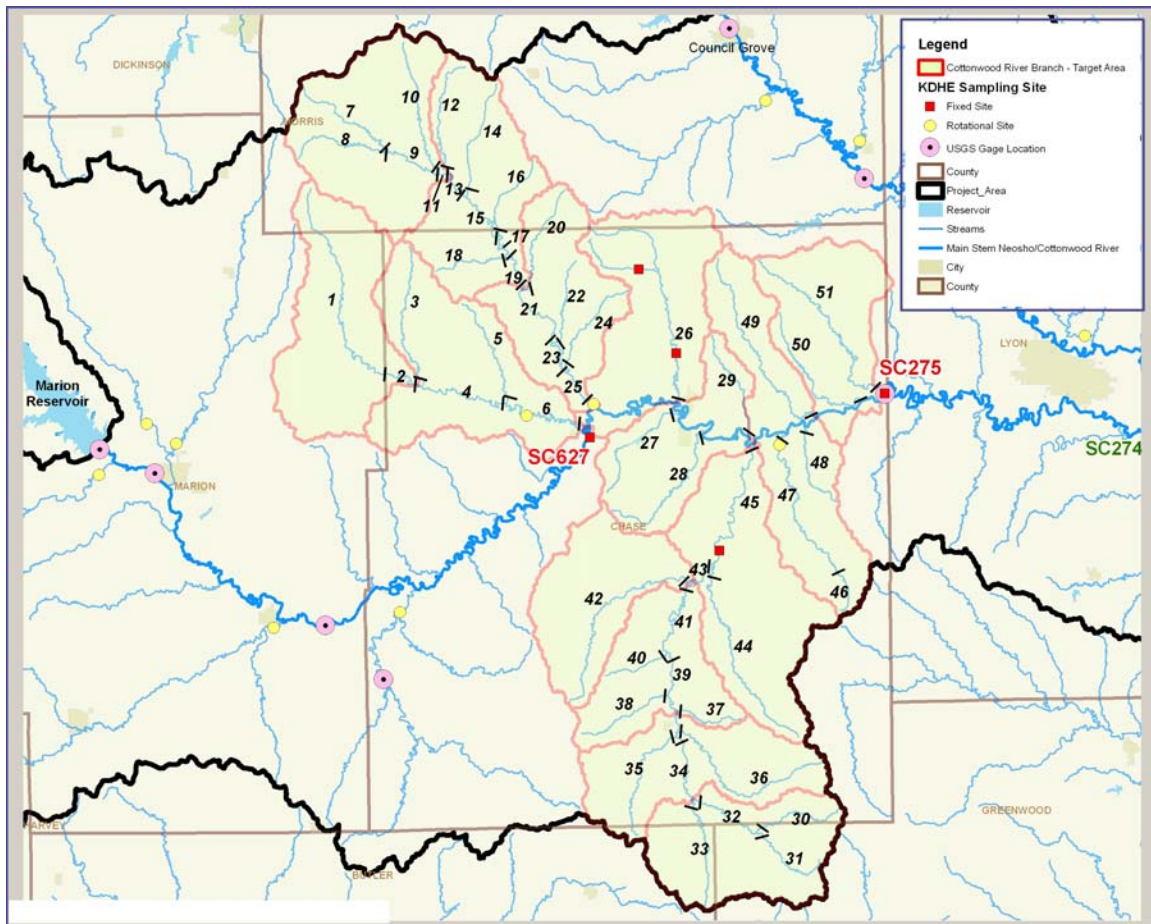


Figure 18: Tributary segments located within the Cottonwood River sediment target area for riparian assessment

There are a number of tributaries to the sediment contribution area of interest on the Cottonwood River branch of the project study area. These tributaries have been segmented in USGS SIR 2004-5033 and are listed in Table 5 along with the flow per unit area for the 2-year estimated peak discharge for the contributing area to each tributary segment. Flows per unit areas for each segment have been adjusted to the area of contribution's incremental gain.

From table 5, those tributary stream segments with the greatest unit flow contribution for the 2-year peak flow are Upper Middle, Collet, Camp, Pickett, Gannon, Fox, Prather, Stout Run, Cannonball, Thurman (above Cannonball confluence), Corn, Kirk, Sharpes, Upper Bloody and Bull Creeks. Assessment of the riparian condition of these tributaries

Tributary Name	Figure 18/19 Segment Reference #	Incremental 2-Yr Peak Flow (cfs)	Incremental Segment Contributing Area (sq mi)	cfs/sq mi
Upper Middle Cr	1	3,620	41.6	87.0
Middle Middle Cr	2	235	3.2	73.4
Upper Stribby Cr	3	1,980	25.2	78.6
Middle Cr (at Collet Cr confluence)	4	3,105	36	85.3
Collet Cr	5	1,750	16.9	103.6
Middle Cr (at Cottonwood R. confluence)	6	230	25	9.3
Upper Six Mile Cr	7	1,410	18.2	77.5
Camp Cr	8	1,090	12.5	87.2
Six Mile Cr (at Mile-and-a-Half Cr confluence)	9	980	20.2	48.5
Mile-and-a-Half Cr	10	1,190	15.1	78.8
Six Mile Cr (at Diamond Cr confluence)	11	490	15	31.8
Upper Diamond Cr	12	952	11.1	85.8
Diamond Cr (at Dodds Cr confluence)	13	-682	3	-252.6
Dodds Cr	14	1030	13	79.2
Diamond Cr (at School Cr confluence)	15	420	17.3	24.3
School Cr	16	1010	12.6	80.2
Diamond Cr (at Pickett Cr confluence)	17	180	13.5	13.3
Pickett Cr	18	856	8.92	96.0
Diamond Cr (at Schaffer Cr confluence)	19	110	10.6	10.4
Schaffer Cr	20	1080	13	83.1
Diamond Cr (at Mulvane Cr confluence)	21	320	20	16.0
Mulvane Cr	22	779	7	111.3
Diamond Cr (at Gannon Cr confluence)	23	150	11	13.6
Gannon Cr	24	1150	12.8	89.8
Diamond Cr (at Cottonwood R. confluence)	25	220	17	12.9
Fox Cr	26	2960	33.9	87.3
Prather Cr	27	1140	12.3	92.7
Buck Cr	28	1650	23.4	70.5
Stout Run	29	1090	11.2	97.3
Cannonball Cr	30	1010	9.3	108.6
Thurman Cr (at Cannonball Cr confluence)	31	1110	11.2	99.1
Thurman Cr (at S. Fk Cottonwood R confluence)	32	690	14.7	46.9
Upper S. Fk Cottonwood R.	33	1260	15.3	82.4
S. Fk Cottonwood R (at Mercer Cr confluence)	34	430	5.1	84.3
Mercer Cr	35	1450	20	72.5
Little Cedar Cr	36	1460	18.6	78.5
Corn Cr	37	860	7.8	110.3
Cocker Cr	38	1210	14.4	84.0
S. Fk Cottonwood R (at Kirk Cr confluence)	39	250	19.3	13.0
Kirk Cr	40	798	6.97	114.5
S. Fk Cottonwood R (at Rock Cr confluence)	41	-280	15	-18.7
Rock Cr	42	2810	33.1	84.9
S. Fk Cottonwood R (at Sharpes Cr confluence)	43	480	35	13.7
Sharpes Cr	44	3370	35.6	94.7
S. Fk Cottonwood R (at Cottonwood R. confluence)	45	590	54	10.9
Upper Bloody Cr	46	971	8.53	113.8
Lower Bloody Cr	47	969	20.57	47.1
Spring Cr	48	1060	10.3	102.9
Peyton Cr	49	1540	20.3	75.9
Bull Cr	50	1160	12.2	95.1
Buckeye Cr	51	1750	24.6	71.1

Table 5: Tributary Stream Segment Unit Flow Contribution to Cottonwood Branch Riparian Assessment Target Area

would initially be directed to these tributaries. Generally, the highest unit yields were from the smaller drainage areas at the upper ends of tributary streams. Included in the initial assessment would also be the main stem of the Cottonwood River between site 275 and 627 (Figure 19).

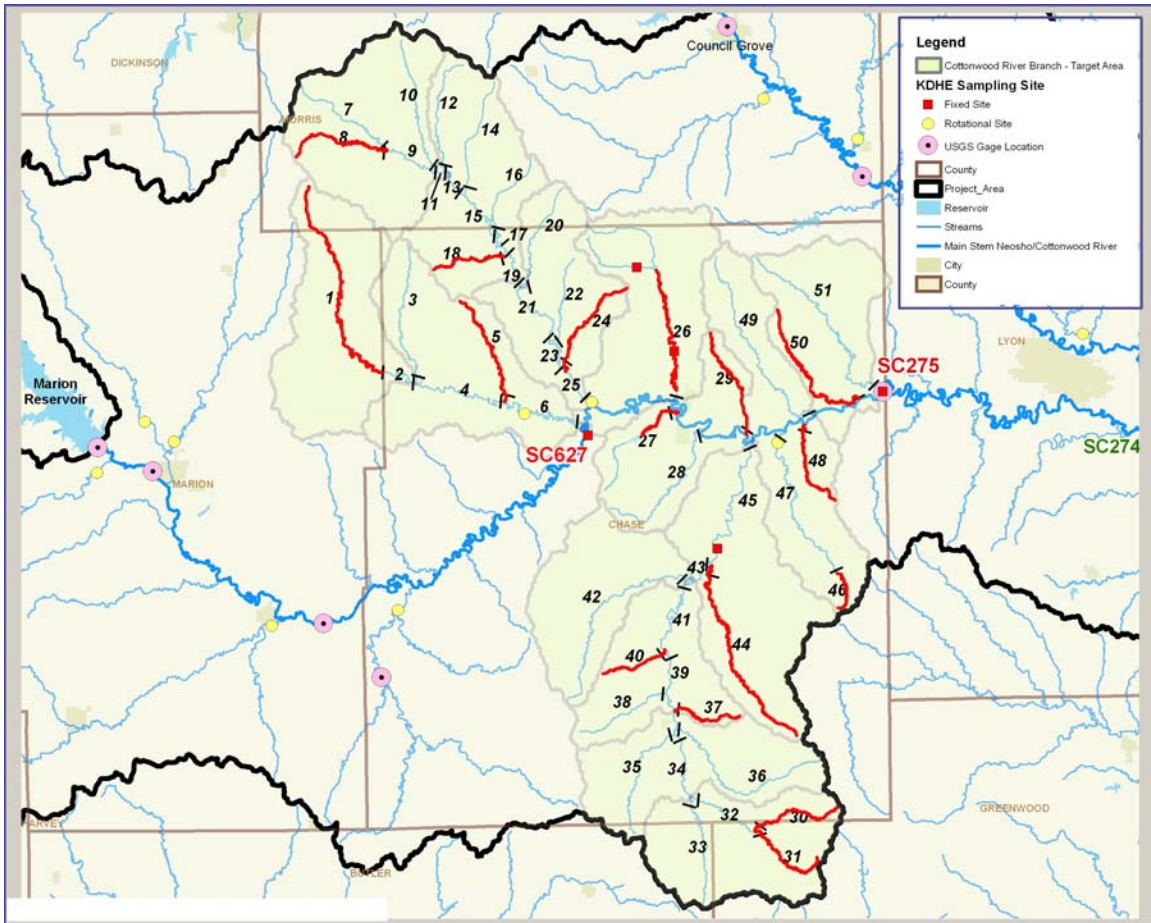


Figure 19: Tributary segments within targeted Cottonwood River Branch watershed with greatest unit flow contribution

John Redmond Project Drainage Area Sediment Flux Summary

Grab samples collected from 1985 through 2007 under the Kansas Department of Health and Environment’s ambient stream chemistry monitoring network were utilized to identify those HUC14s with the greatest sediment flux per unit area and stream length within the John Redmond Reservoir feasibility study project area. This assessment is based upon a watershed comparison of total suspended solid concentrations from concurrently collected samples. Figure 20 shows the drainage areas with relatively greater per unit area and stream length sediment flux (red HUC14s in Figure 20). The drainage area of interest on the Neosho River above its confluence with the Cottonwood River has the largest sediment flux of any drainage area assessed in this report should be emphasized for riparian assessment and, subject to the results of the riparian assessment, potential management practice implementation.

Flow characteristics of tributary stream segment within the targeted watersheds were review using United State Geological Survey Scientific Investigation Report 2004-5033. This review identified individual tributary segments (Figures 17 and 19) within the targeted areas that have greater potential to contribute sediment loads based upon their unit flows. Again, the targeted area on the Neosho River branch in the study area should be emphasized for riparian assessment, because it has the largest sediment flux of any drainage area capable of being assessed in this report.

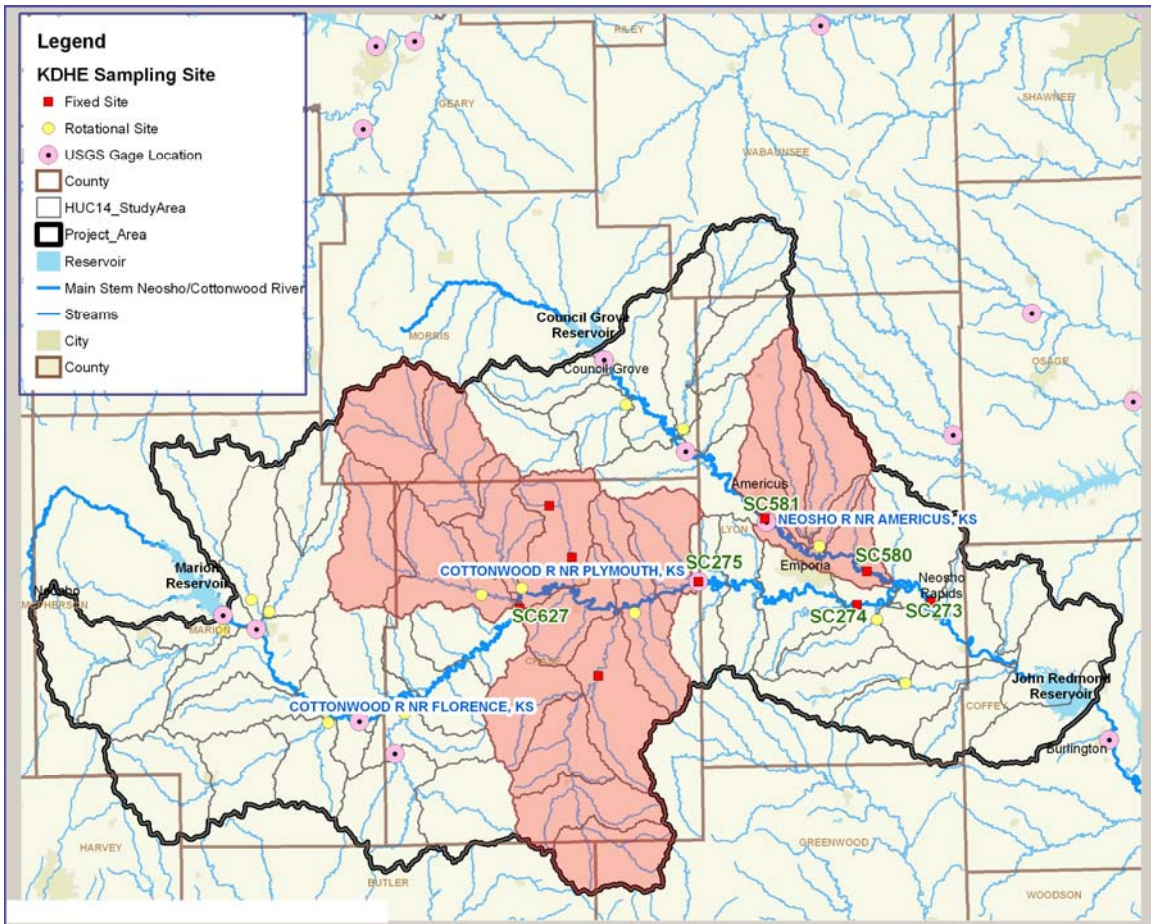


Figure 20: Watersheds with greatest sediment flux on the Cottonwood River and Neosho Rivers in the John Redmond Reservoir feasibility study project area.