SOLOMON BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody/Assessment Unit: Lower N. Fk. Solomon River to Twelvemile Creek
Water Quality Impairment: E coli Bacteria

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower N. Fk. Solomon River

County: Osborne, Phillips, Rooks and Smith

HUC 8: 10260012

HUC 10 (HUC 12s)**:**
01 (01, 02, 03, 04, 05, 06 and 07)
02 (01, 02, 03, 04, 05, 06 and 07)
03 (01, 02, 03, 04, 05, 06, 07, 08, 09 and 10)
04 (01, 03)

Ecoregion: Central Great Plains – Rolling Hills and Breaks (27b)

Drainage Area: 1047 square miles

Main Stem Segment: WQLS: 7 (N. Fk. Solomon R.) lying between the confluence of Spring Creek and the confluence of Twelvemile Creek, near Portis, along the Smith – Osborne county line (**Figure 1**)

Main Stem Segment	Tributary (see Appendix B)
7	Lawrence Crk (44)
	Spring Cr (8)
9	Beaver Crk (10)
	E.Branch Beaver Crk (11)
	Middle Beaver Crk (13)
	West Beaver Crk (14)
15	Cedar Crk (16)
	E. Cedar Crk (17)
	Cedar Crk (18)
	Middle Cedar Crk (19)
	E. Middle Cedar Crk (37)
	W. Cedar Crk (20)
21	Glen Rock Crk (41)
22	Deer Crk (23)
	Plum Crk (24)
	Deer Crk (25)
	Deer Crk (27)
	Spring Crk (28)
	Deer Crk (29)
	Plotner Crk (30)
	Deer Crk (31)
	Starvation Crk (38)
	Boughton Crk (34)

Designated Uses: All streams in Lower North Fork Solomon Sub-basin have Expected Aquatic Life support and secondary "b" contact recreation designation, except Segment 7 of the NF Solomon which has a Primary "C" contact recreation designation. All segments of the Lower NF are designated for domestic water supply, food procurement, ground water recharge, irrigation, industrial and stock water supply, as is Segment 29 of Deer Creek. Tributary Segments 10, 11, 14, 23, 25, 27, 28, 31 and 44 are all designated for food procurement. East Cedar Creek (17) is designated for food procurement and livestock watering. Plotner Creek (30) is designated for food procurement, ground water recharge, irrigation and livestock watering. Spring Creek (8) is designated for ground water recharge, irrigation and livestock watering.

303(d) Listings: The NF Solomon River monitored by Station SC014 cited as impaired by E coli bacteria in the 2008-303(d) list for the Solomon Basin.

Impaired Use: Primary Contact Recreation

Water Quality Criteria: K.A.R. 28-16-28d. Surface water classification and use designation. (a) Surface water classification. Surface waters shall be classified as follows:

(1) Classified stream segments shall be those stream segments defined in K.S.A. 82a- 2001(a), and amendments thereto. (K.S.A. 82a-2001(a) provided in Appendix A)

K.A.R. 28-16-28e(c)(7):
(D) Primary contact recreation for classified stream segments. At least five samples shall be collected during separate 24-hour periods within a 30-day period. A geometric mean analysis of these samples shall not exceed the criteria in table 1i, as adopted in subsection (d) of this regulation, beyond the mixing zone.

(E) Secondary contact recreation for classified stream segments. The following criteria shall be in effect from January 1 through December 31 of each year. At least five samples shall be collected during separate 24-hour periods within a 30-day period. A geometric mean analysis of these samples shall not exceed the criteria in table 1i, as adopted in subsection (d) of this regulation, beyond the mixing zone.

(F) Wastewater effluent shall be disinfected if it is determined by the department that the discharge of non-disinfected wastewater constitutes an actual or potential threat to public health. Situations that constitute an actual or potential threat to public health shall include instances in which there is a reasonable potential for the discharge to exceed the applicable criteria supporting the assigned recreational use designation or if a water body is known or likely to be used for either of the following:

(i) Primary or secondary contact recreation; or
(ii) any domestic water supply.

Table 1i. Escherichia coli Criteria For Classified Stream Segments.

USE	Colony Forming Units (CFUs)/100mL	
PRIMARY CONTACT	Geometric Mean	Geometric Mean
RECREATION	April 1 – Oct. 31	Nov. 1 – March 31
Class A	160	2358
Class B	262	2358
Class C	427	3843
SECONDARY CONTACT	Geometric Mean	
RECREATION	Jan. 1 – Dec. 31	
Class a	2358	
Class b	3843	

Note: The term "counts" in this TMDL will refer to the criteria parameter: CFUs / 100 ml

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Uses under 2008- 303(d): Bacteria levels on the North Fork Solomon River at Portis (SC014) exceeded the geometric mean criteria in April 2006. No other geometric mean based sampling occurred on Deer or Beaver Creeks.

Stream Monitoring Sites and Period of Record: KDHE permanent ambient Stream Chemistry sampling station SC014, located on the North Fork of the Solomon River on the Highway 281 bridge 0.5 miles south of Portis has E coli data from 2003-2009 **(Figure 1)**. A permanent sampling station SC721, located on Deer Creek north of Kirwin similarly has E coli data from 2003-2009. A rotational sampling station, SC670, on Beaver Creek at Gaylord has data from 2004 and 2008. There is another permanent station, SC544, on Oak Creek near Cawker City, but that drainage joins the North Fork at Waconda Lake.

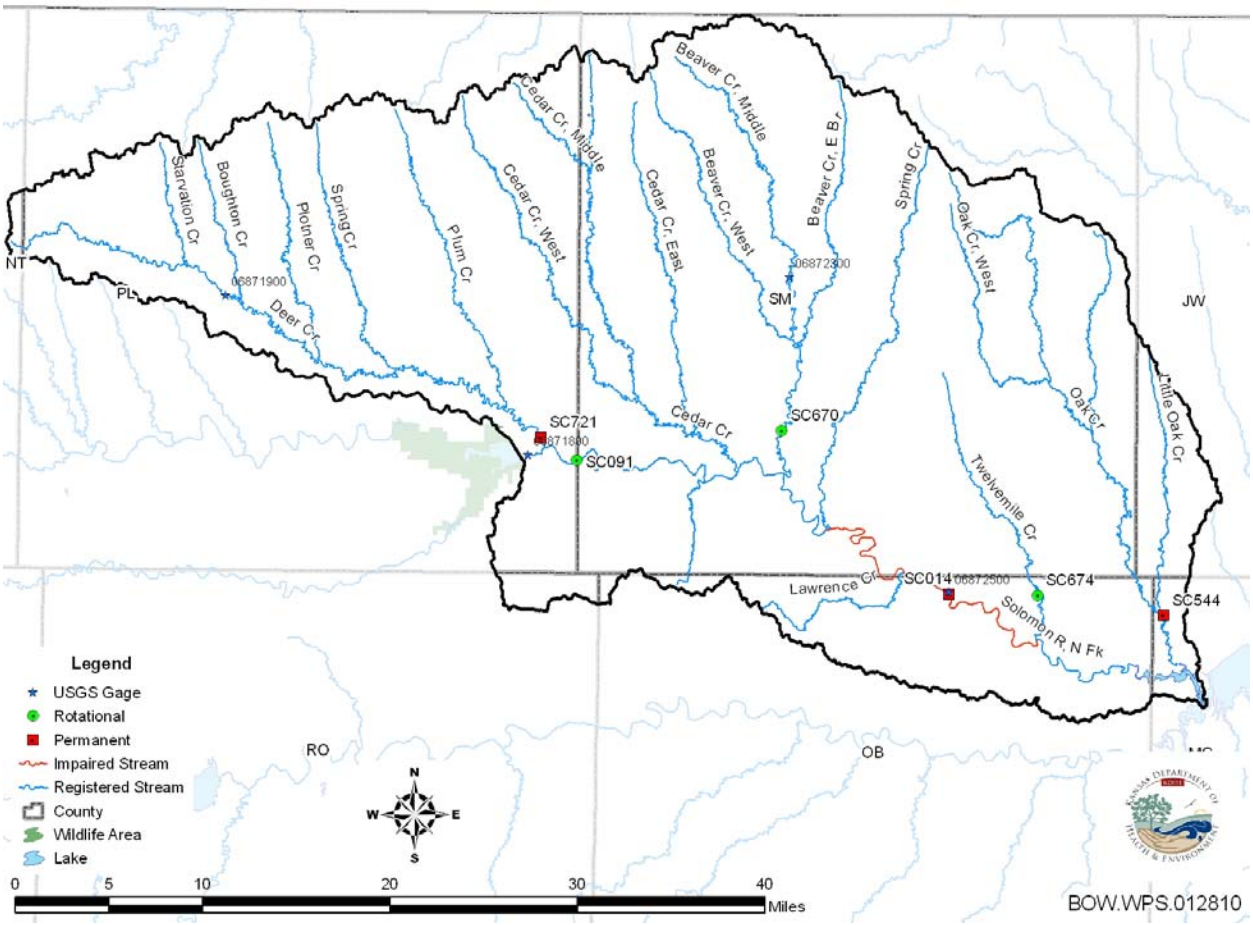

Figure 1 Lower North Fork of the Solomon River Sub-basin

Hydrology: The USGS has maintained a gaging station (06872500) on the North Fork of the Solomon River at Portis since 1945. An upstream station at Kirwin was in operation from 1919 to 2002. Since 1990, there has been little discharge out the main river outlet at Kirwin dam, but substantial gains in flow are seen between Kirwin and Portis (**Figure 2**). Flow conditions at Portis dried somewhat during the 2003-2009 period, relative to flows seen over 1990 – 2002. Irrigation return flows and canal waste releases to the river likely comprise much of the increase in flow seen at Portis. For the purposes of this TMDL, the flow at Portis represents the watershed outflow expected at the downstream end of Segment 7, since any gain in flow below the gage lies within the inherent measurement error of flows recorded at the USGS gage. KDHE sampling for E coli bacteria since 2003 has been predominantly at the lower flow conditions **(Figure 3).** Sampling at higher flows occurred with the resumption of wet conditions in 2007 to present (**Figure 4**). Despite the lower flows over 2003-2006, elevated E coli bacteria was seen. The geometric mean violations occurred at low flows in April of 2006, averaging 10.1 cfs during each of the five sampling visits.

Over the past two decades, the high flow period occurs over May thru August, when irrigation flows move through the system (**Figure 5**). The more recent seven-year period when E coli

sampling occurred had significantly lower flows and a solitary peak in May followed by recession through the summer into the traditional baseflow period of autumn.

Use attainability analysis surveys conducted by KDHE staff along the Lower North Fork below Kirwin Dam in 2005 showed good flow throughout the reaches but shallow depths. Stream depth was about half-foot from the Phillips-Smith county line to Gaylord, increasing to about one-foot of depth below Gaylord past Portis toward Waconda Lake.

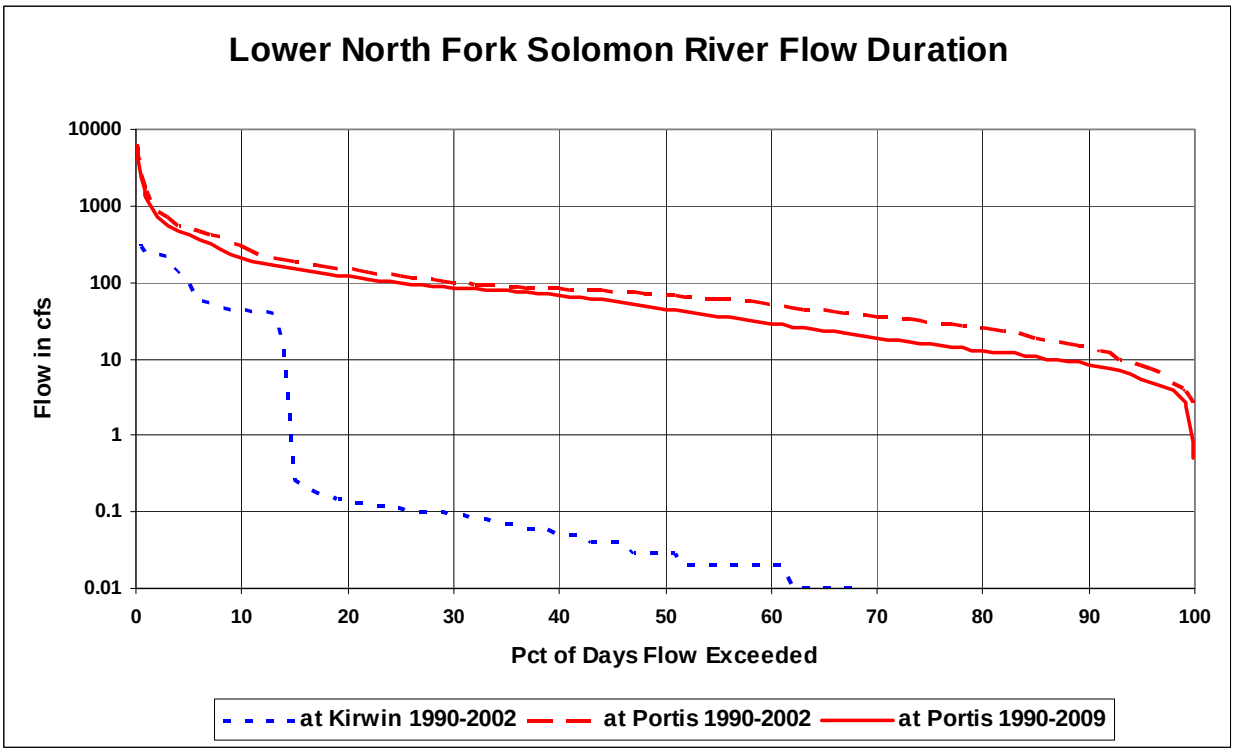

Figure 2. Flow Duration for Lower North Fork Solomon River at Kirwin and Portis

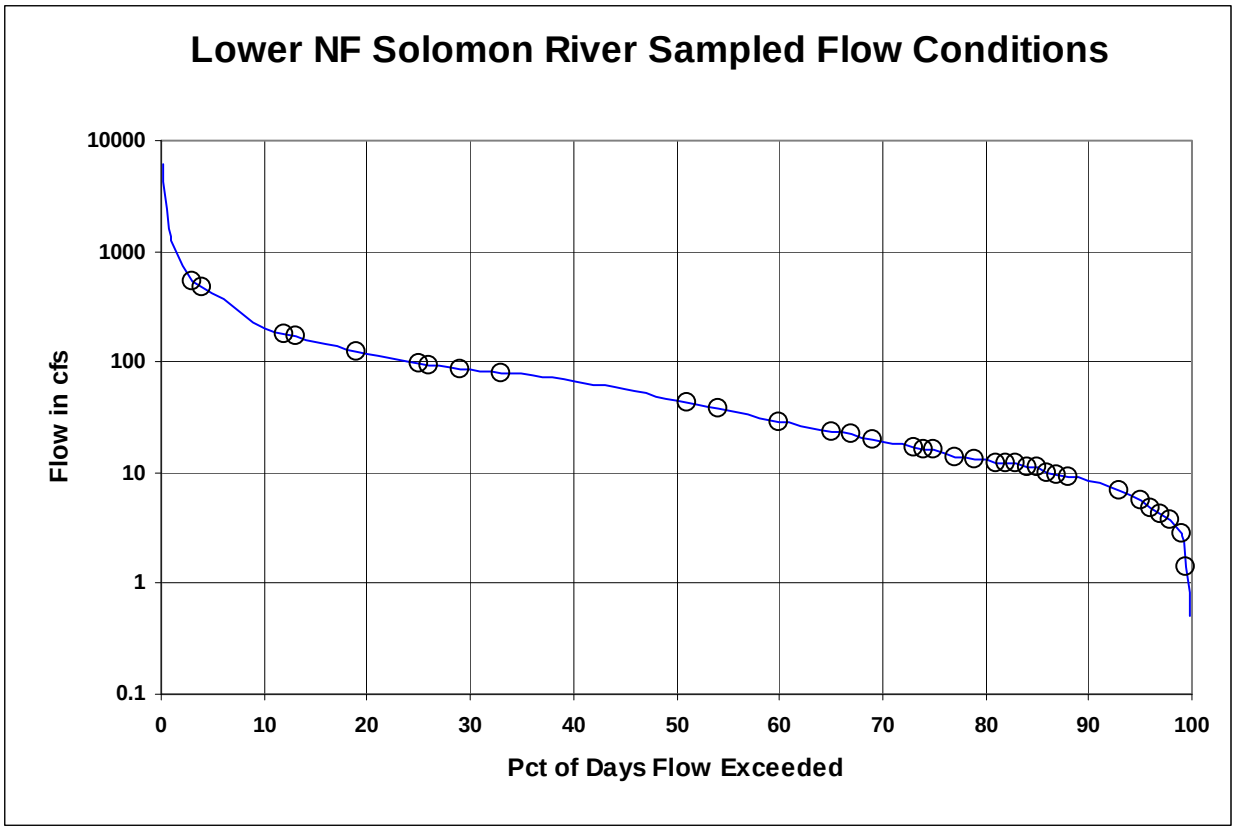

Figure 3. 2003-2009 E coli Bacteria Sampling Distribution along Flow Conditions

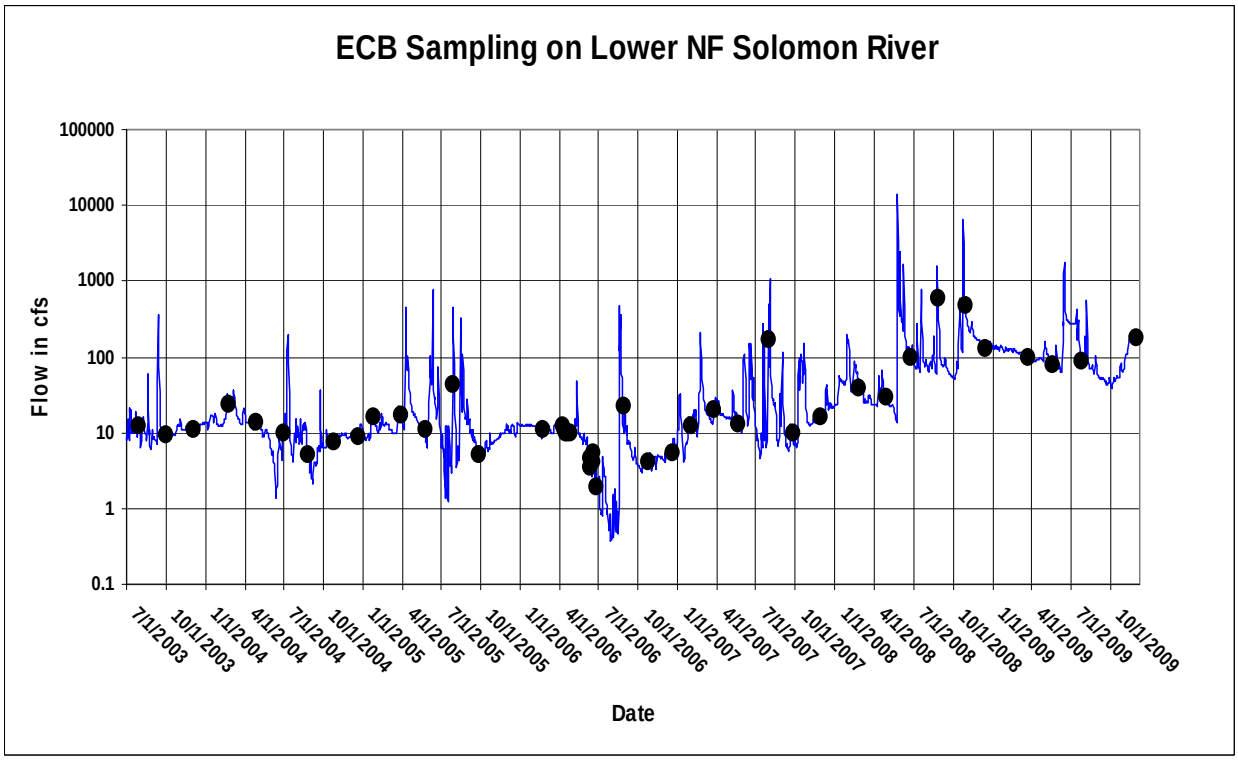

Figure 4. Daily Flows of North Fork Solomon River during 2003-2009 E coli Sampling

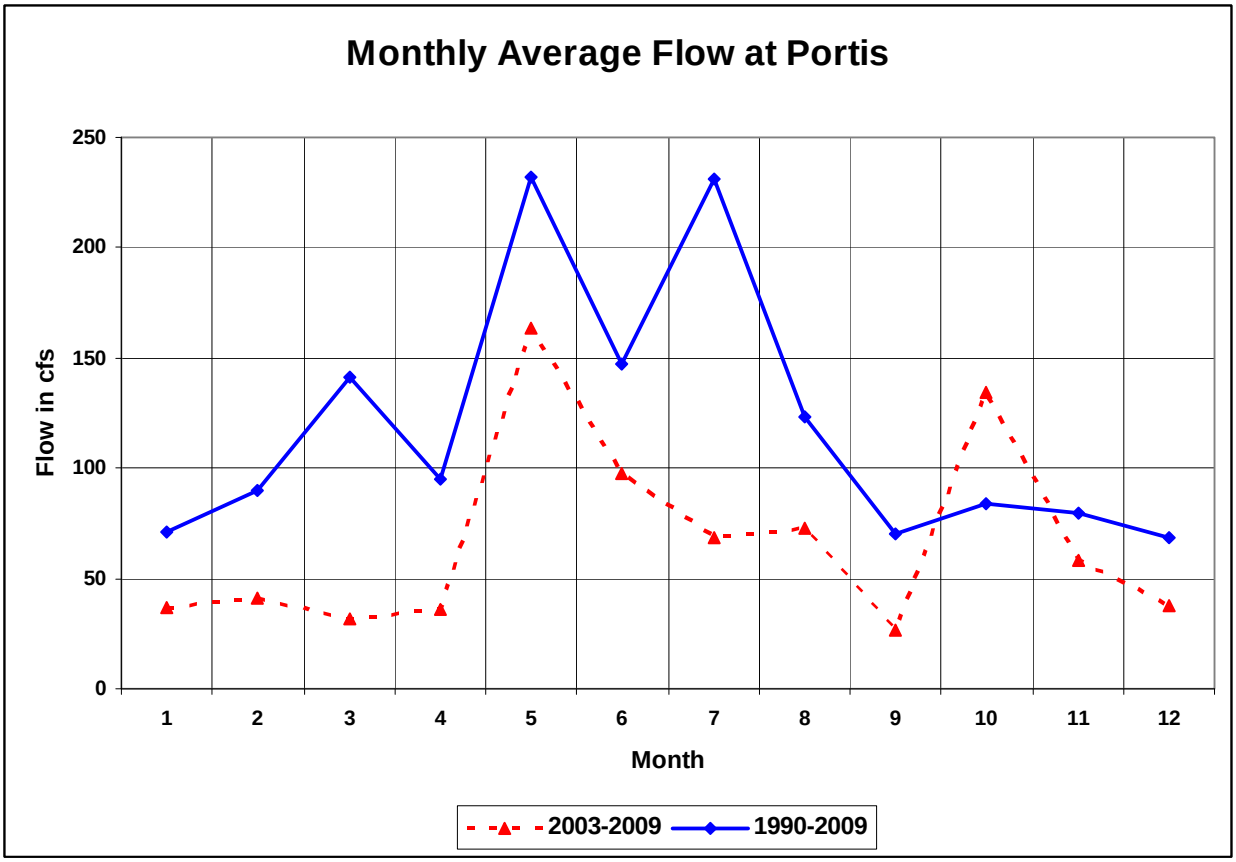

Figure 5. Monthly Average Flows on Lower North Fork of Solomon River

Bacteria Concentrations: E coli bacteria (ECB) was sampled at Portis from July 2003 on (**Figure 6**). Geometric mean of overall ECB data was 236 at Portis (SC014) but isolating on the primary recreation season (April – October), the geometric ECB mean rose to 540 counts. Two sets of intensive sampling (five samples taken in a 30-day period) occurred in April and June of 2006. The geometric mean of the April samples was 782 counts and that for June was 502 counts, both values justifying listing the stream for impairment by bacteria in 2008.

High bacteria levels are seen during most primary contact recreation seasons, the off-season (November thru March) values are substantially lower. Five of the past seven primary recreation seasons have seen geometric means of samples taken in those months exceed the nominal criterion value for primary recreation (427 counts). These annual seasonal geometric means are not legal cause for citing impairment by bacteria, but give an indication of the persistence of high during April thru October in most years.

Plotting bacteria counts against the ambient flow at the time of sampling shows high bacteria occur more often at flows over 10 cfs (**Figure 7**). Flows between 10 and 100 cfs do not automatically translate to high bacteria; there were more samples below 427 counts in that flow range than what exceeded that value. However, flows over 100 cfs would always have high bacteria. Off-season bacteria levels were low at any flow condition.

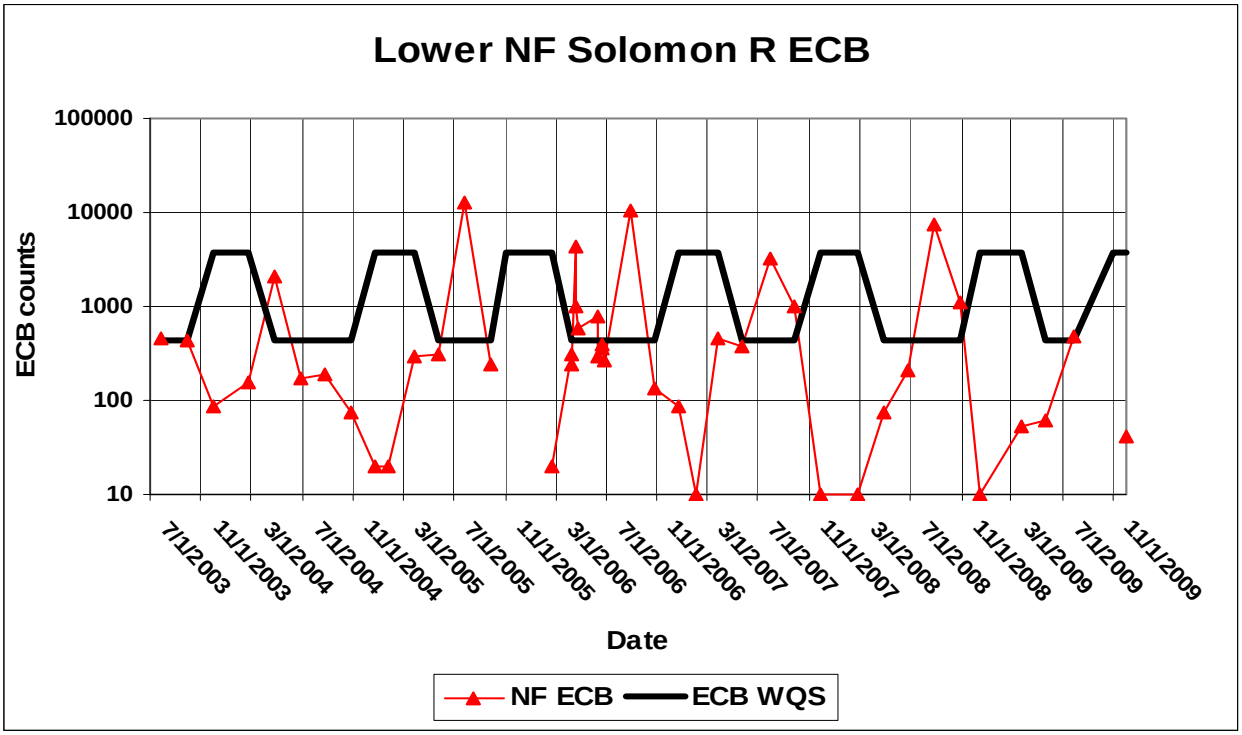

Figure 6. E coli Bacteria Counts on Lower North Fork of the Solomon River

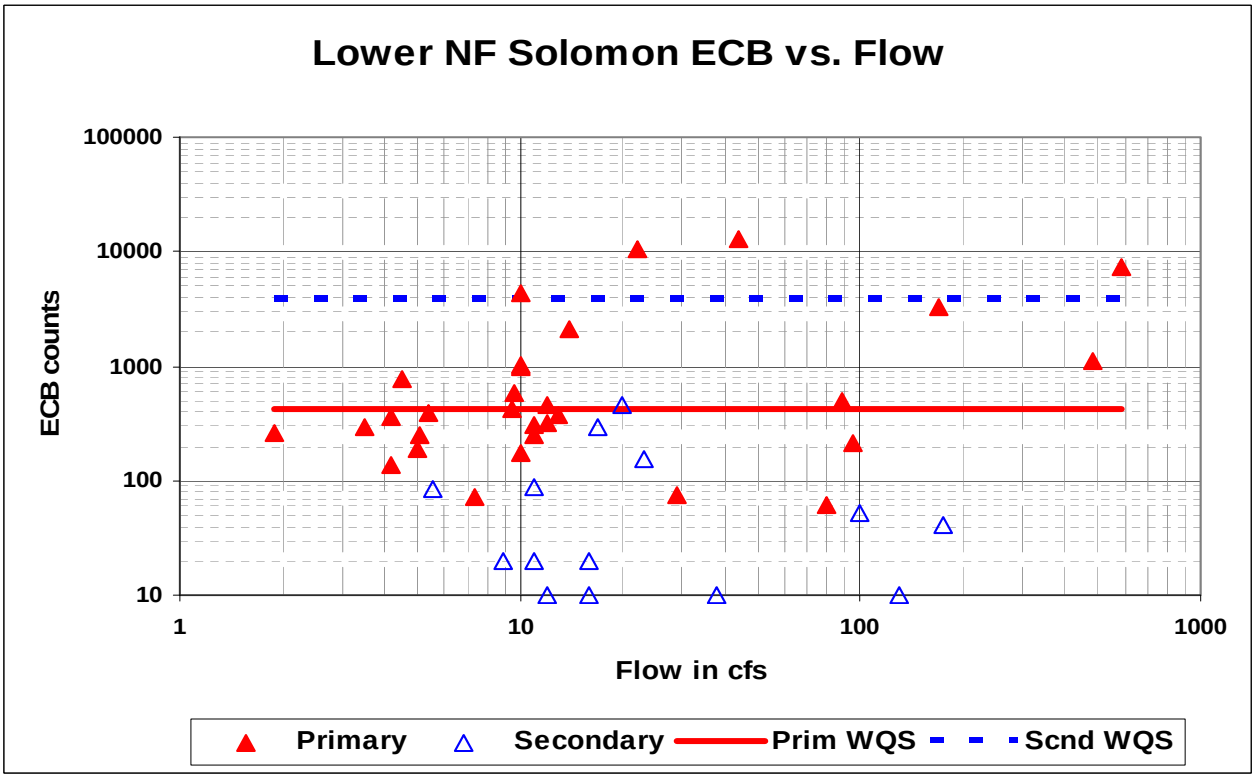

Figure 7. Bacteria and Flow on Lower North Fork of the Solomon River, 2003 – 2009

If the flow-bacteria relation is viewed in the context of flow condition or flow duration (**Figure 8**), the high bacteria counts begin to occur at flows exceeded 90% of the time or less. Only one sample was larger than 427 counts at very low (90-99%) flows; most of the high bacteria occurred between median flow and the upper decile (90%) flow. The three samples taken at flows greater than 100 cfs congregate near the lower decile (10%) flow. The difference between median flow (45 cfs) and upper decile flow (~10 cfs) is not substantial. This reflects the moderating influence of upstream Kirwin dam and the return of irrigation water into the North Fork throughout the valley. High flow inputs come from the tributary watersheds north of the main stem of the river.

Bacteria levels on Deer and Beaver Creeks in 2004 and 2008 were typically greater than corresponding bacteria concentrations on the North Fork at Portis (**Figure 9**). At very high flows, exceeding 400 cfs, the watershed appears to act as a solitary unit with uniform bacteria levels. Tributary contributions appear to cause downstream elevation in bacteria. Since Deer Creek is monitored on a similar schedule as Portis, **Figure 10** shows a more extensive pattern of contribution to the North Fork. High bacteria levels seen at Portis typically correspond to high concurrent concentrations on Deer Creek.

There is a strong relationship between bacteria and suspended solids (**Figure 11**). A similar, albeit weaker relationship exists between bacteria and phosphorus (**Figure 12**). The pattern is the same for the main stem as its two main tributaries, Deer and Beaver Creeks. The relationships imply the same mechanism of load delivery occurs in the watershed. Regardless of the level of actual recreation use occurring on the Lower North Fork of the Solomon River, reductions in bacteria contributions will also work toward reducing the loads of nutrients and sediment to Waconda Lake through the North Fork.

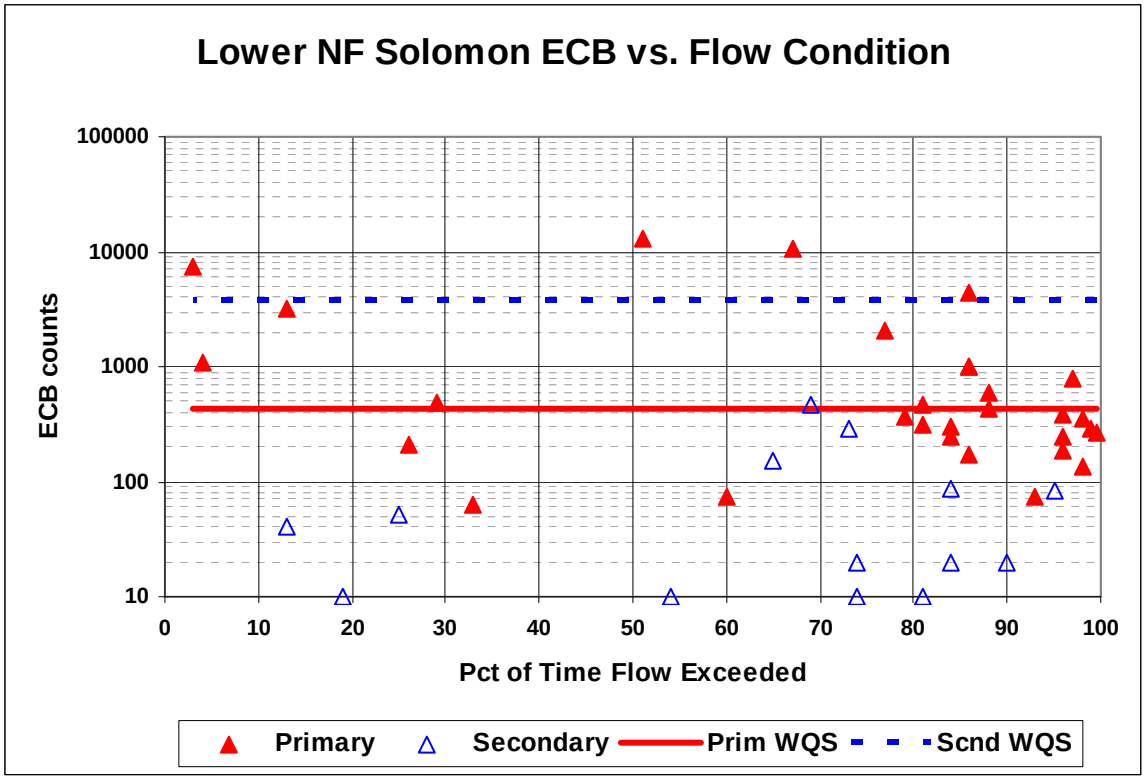

Figure 8. Bacteria at Varying Flow Condition on North Fork of the Solomon River.

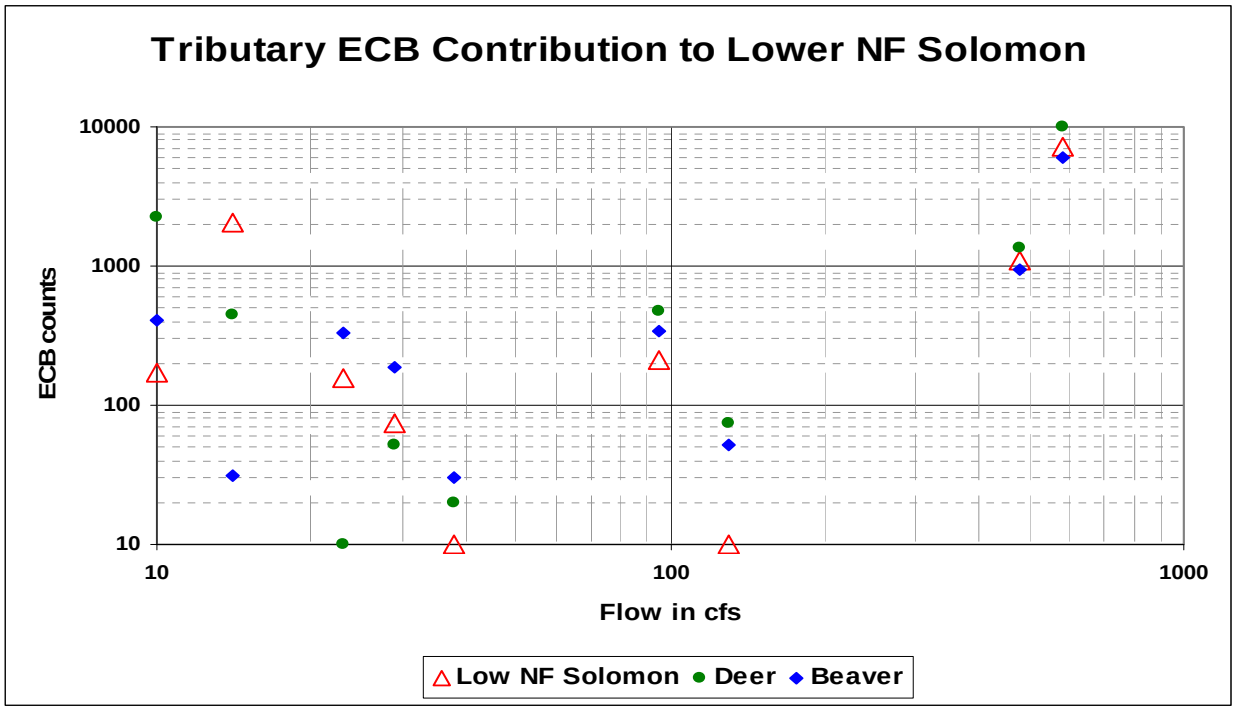

Figure 9. Tributary Contribution of E coli Bacteria to Lower North Fork Solomon River

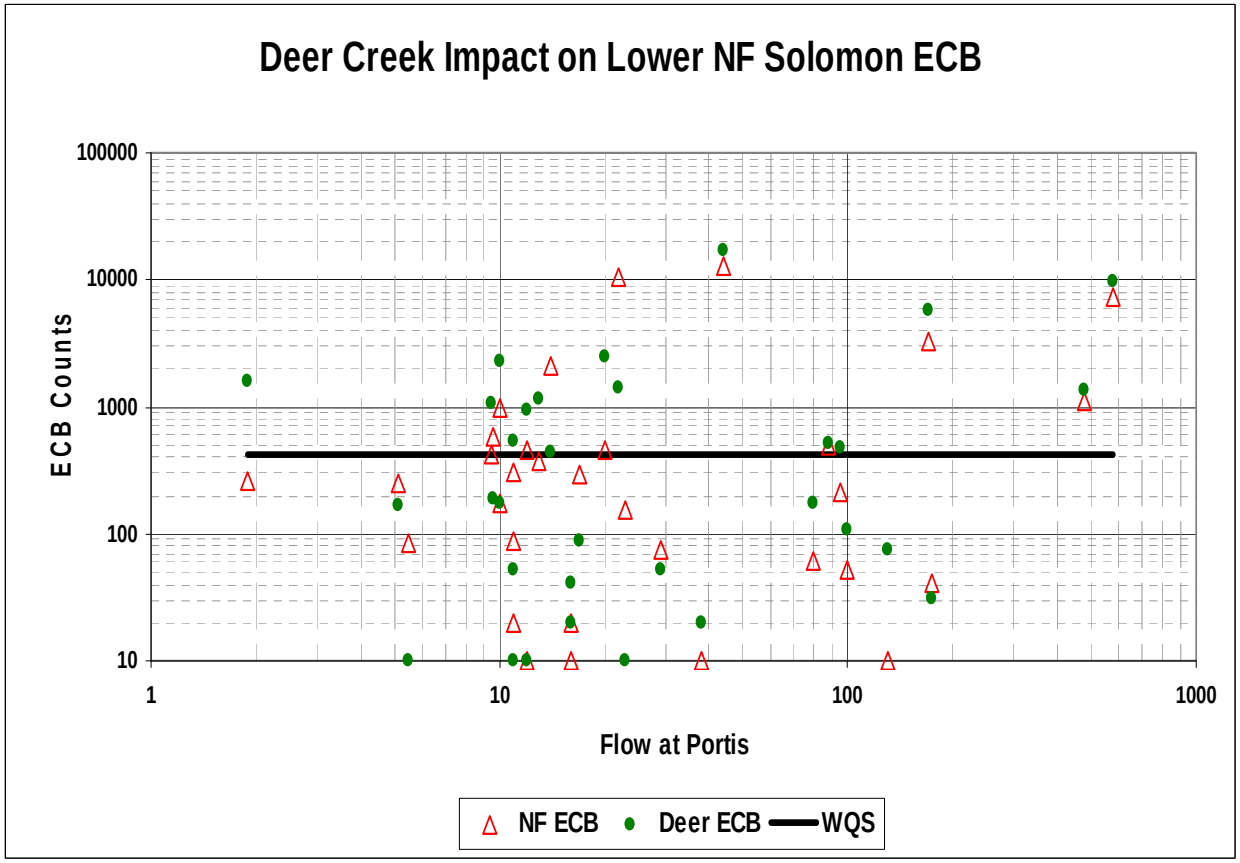

Figure 10. Deer Creek Contributions of Bacteria to Lower NF Solomon River

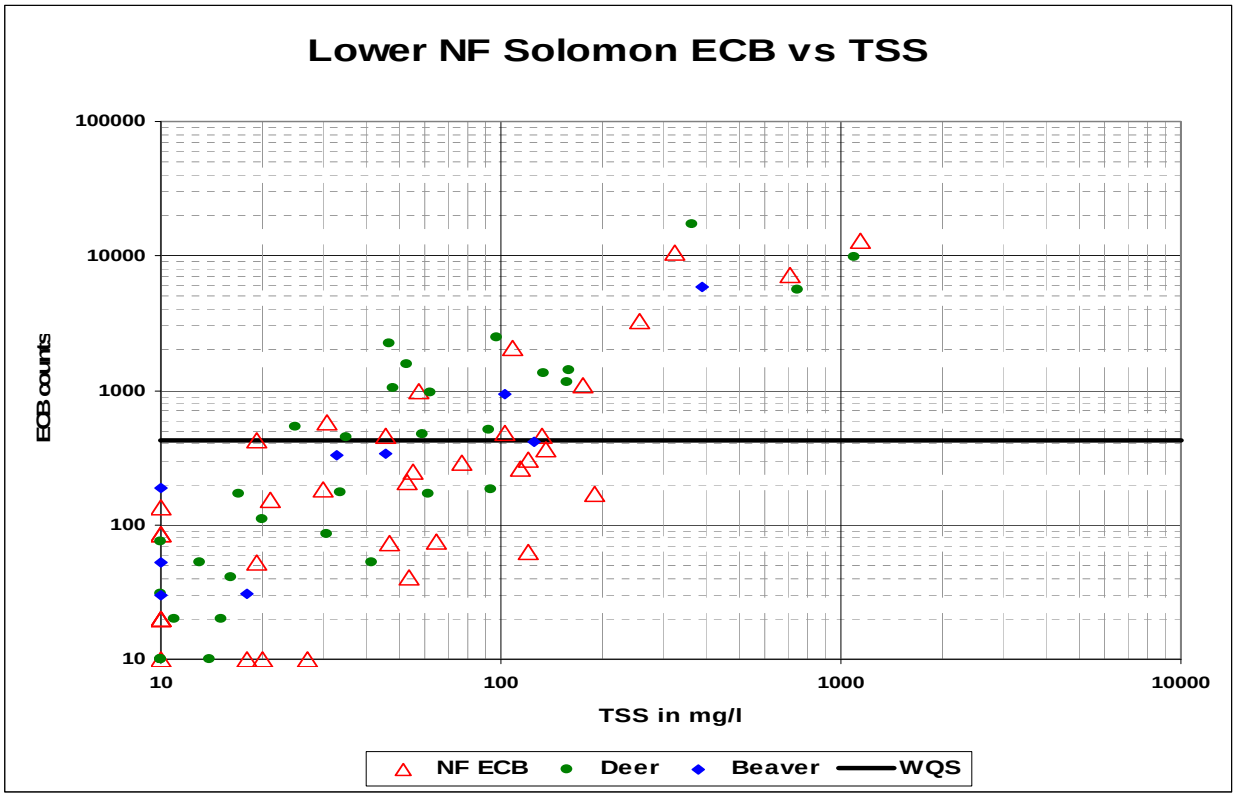

Figure 11. Bacteria – Suspended Solids Relationship in Lower North Fork Solomon Subbasin

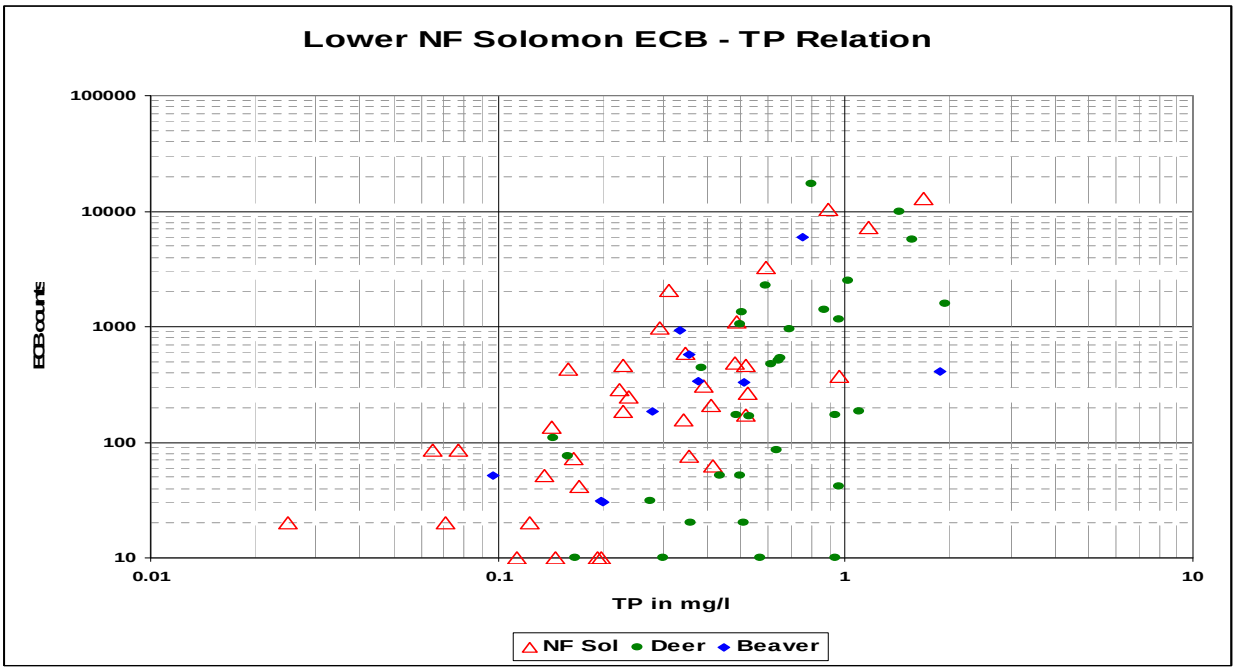

Figure 12. Bacteria – Phosphorus Relationship in Lower North Fork Solomon Subbasin

One way to look at the pattern of E coli presence along the North Fork of the Solomon River is to plot the respective ECB index profiles for stations at Portis and in the vicinity **(Figure 13).** The index is computed for the samples taken during the primary (April – October) period and is the natural log of each sample's bacteria count, divided by the natural log of the applicable criterion, in this case 427 counts. The resulting values normalize each bacteria sample to the criterion and profiles can be derived by the cumulative frequency distribution of those index values.

In the case of the lower North Fork, the Portis station displays an elevated profile, similar to the profile for Beaver Creek, but less so than that for Deer. However, those tributary streams are not impaired because of their designation supporting only secondary contact recreation. Ideally, at least 90% of the future Portis samples during April thru October will lie below 427 counts. The profiles imply Deer Creek might be a major contributing area to bacteria seen at Portis. With implementation of controls and management practices, the future profile at Portis should decline until a majority of samples lie below the criteria line. This would indicate reductions in the magnitude, duration and frequency of bacteria levels along the North Fork. The utility of the index profile is to use routine sample data to assess bacteria conditions until such time that use of the more intensive (five times in 30 days) sampling is conducted to assess compliance with the water quality standards.

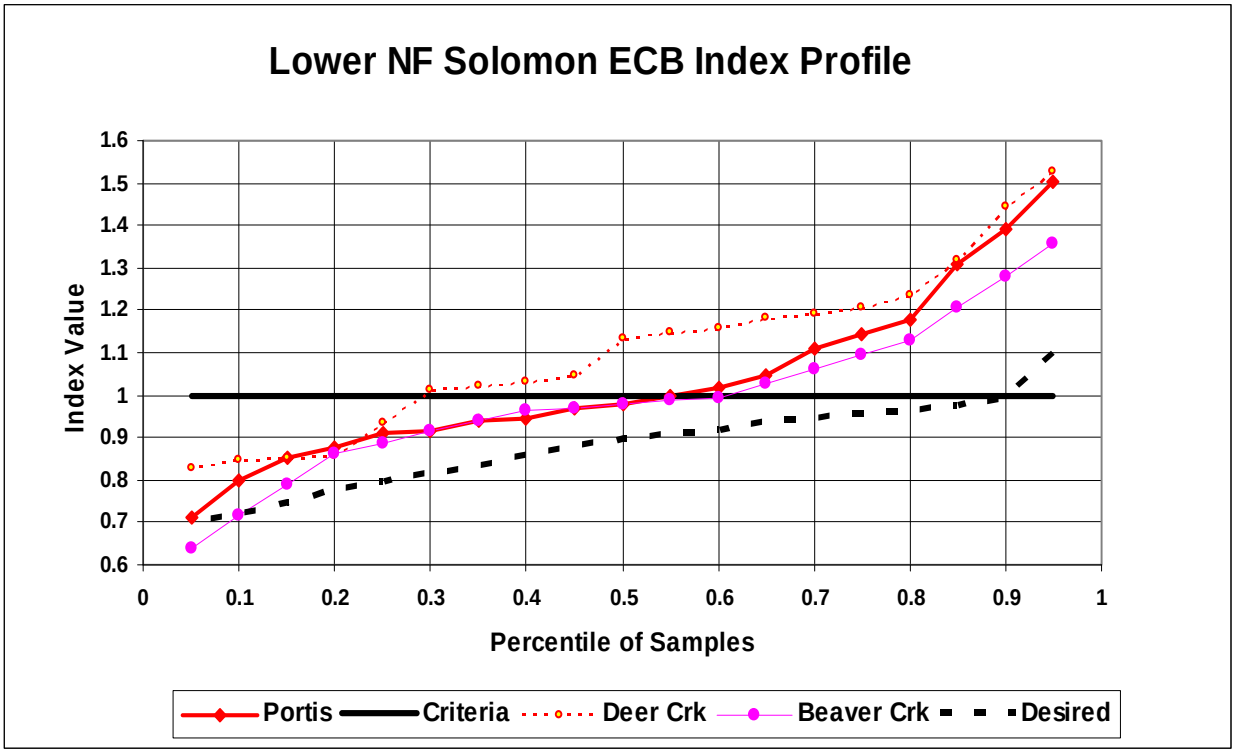

Figure 13. E coli Bacteria Index Profile for North Fork Solomon Streams

Use Attainability: Use Attainability Analyses were conducted in 2005 in the Lower North Fork Solomon Sub basin. The only segment found to support Primary recreation was Segment 7 in the vicinity of Portis. Upstream and downstream segments are too shallow to support primary contact recreation. Because of limited access, it has been designated as Class C. The Portis monitoring site lies within the segment and sampling at that station against the Class C criterion caused the stream to be cited as impaired. The remaining segments had average depths of 0.5 to one foot. Similarly, the tributaries to the Lower North Fork were of shallow depth. Certain streams lost their status as classified streams because of their diminished hydrology and lack of a defined channel. As ephemeral streams, they would flow only with excessive rainfall and runoff.

Streamflow measurements at the USGS gage at Portis (06872500) from 1987 - 2008 were used to establish a dataset of flow, depth and velocities across a wide range of flow conditions. Regression equations were used to establish hydraulic geometry relations for depth (**Figure 14**) and velocity (**Figure 15**):

Velocity = 0.521 * Flow^0.225 (R2 = 72%)
Depth = 0.191 * Flow^0.432 (R2 = 88%)

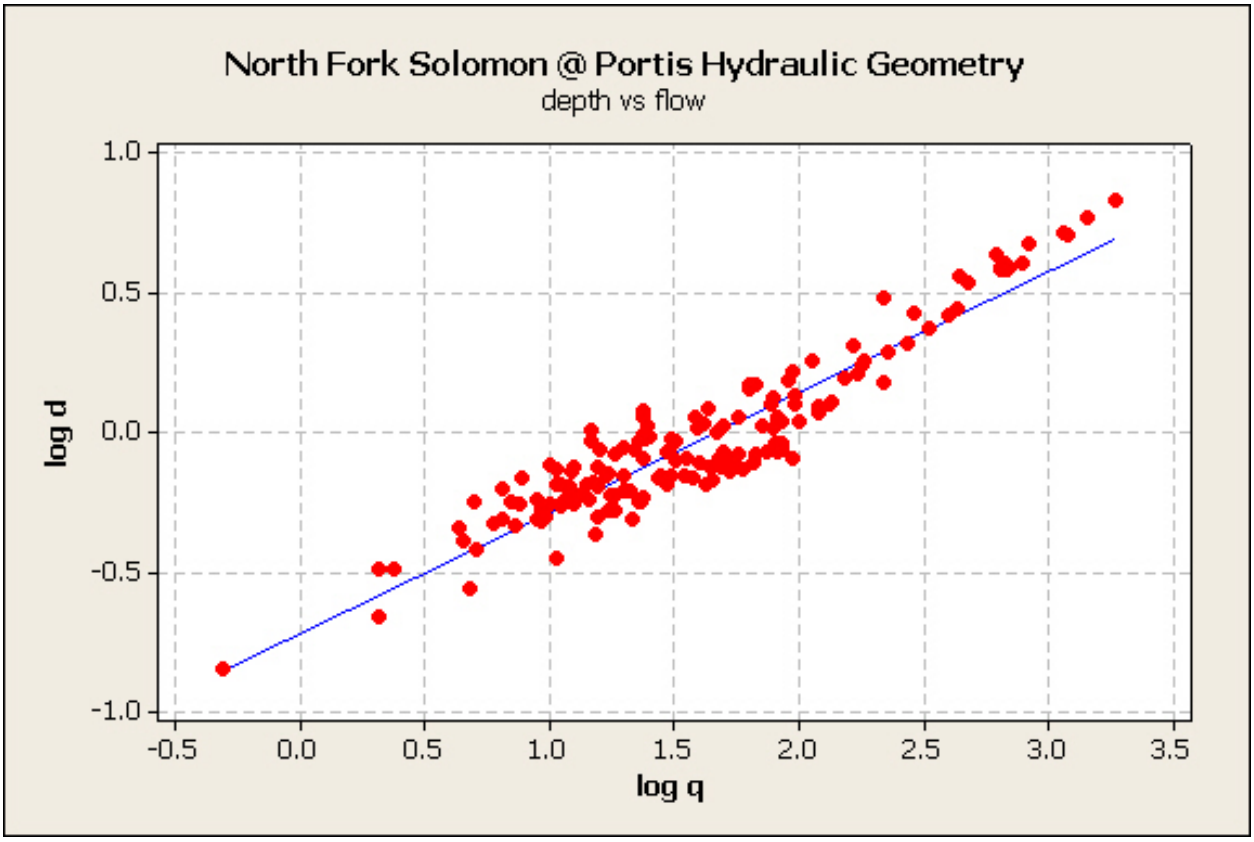

Figure 14. Log-normal relationship of depth & flow on North Fork Solomon at Portis

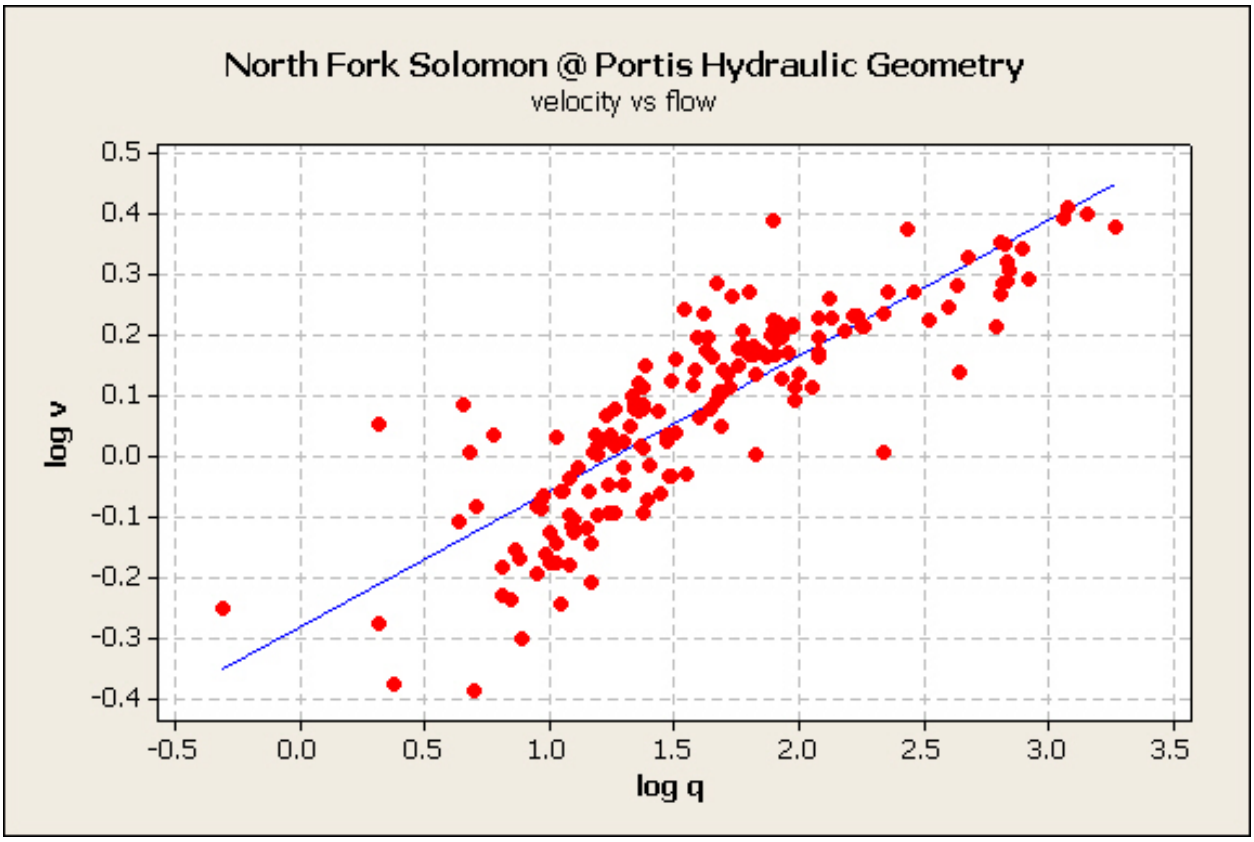

Figure 15. Log-normal relationship of velocity & flow on North Fork Solomon @ Portis

These relations were used to convert the flow duration curve into duration curves for specific depths and velocities. For this TMDL, although average depths over one and a half feet suggest primary contact recreation in Kansas, average depths of 1.25 feet designated support for primary recreation. Average velocities over two feet per second constrain primary recreation because of safety concerns. Additionally, USGS protocols Jim Putnam, USGS, pers comm., 2008) for stream wading suggest if the depth-velocity (dxv) product exceeds the wader's height, nominally, six feet, the stream is not safe to enter.

Figure 16 displays the estimated depth and velocity conditions seen over time on the North Fork. Despite its relatively flat slopes, wide channels and marginal hydrology, optimal conditions for primary contact recreation on the reach at Portis can occur once flows exceed the median flow. Unsafe conditions only occur for a very small percentage of time. Therefore, the primary recreation condition is conservatively suggested to be at flows exceeded 5-35% of the time. This relation tends to support the designation of this reach as supporting primary recreation, although most of the streams in the watershed are shallow and only support secondary contact recreation.

Desired Endpoint: The ultimate endpoint of this TMDL will be to achieve the Kansas Water Quality Standards and support primary recreation on the Lower North Fork of the Solomon River. This requires geometric means of five samples taken within a 30-day period to be below the applicable criterion during April to October. For the purposes of this TMDL, the criterion will be 427 counts of E coli bacteria at Portis in Smith and Osborne counties. This reflects the recreation class designation for Segment 7, despite the marginal recreation opportunities present

along the North Fork Solomon River below Kirwin Dam. Reduction in bacteria loading along the tributaries of the North Fork will be conducted with the objective of reducing the ambient bacteria concentrations seen on the North Fork. Because of the coincident elevation of sediment and nutrients during periods of high bacteria, implementation of this TMDL will effectively reduce all three pollutants above Waconda Lake.

Achievement of these endpoints indicate any loads of bacteria are within the loading capacity of the stream, water quality standards are attained and full support of the designated uses of the stream has been restored.

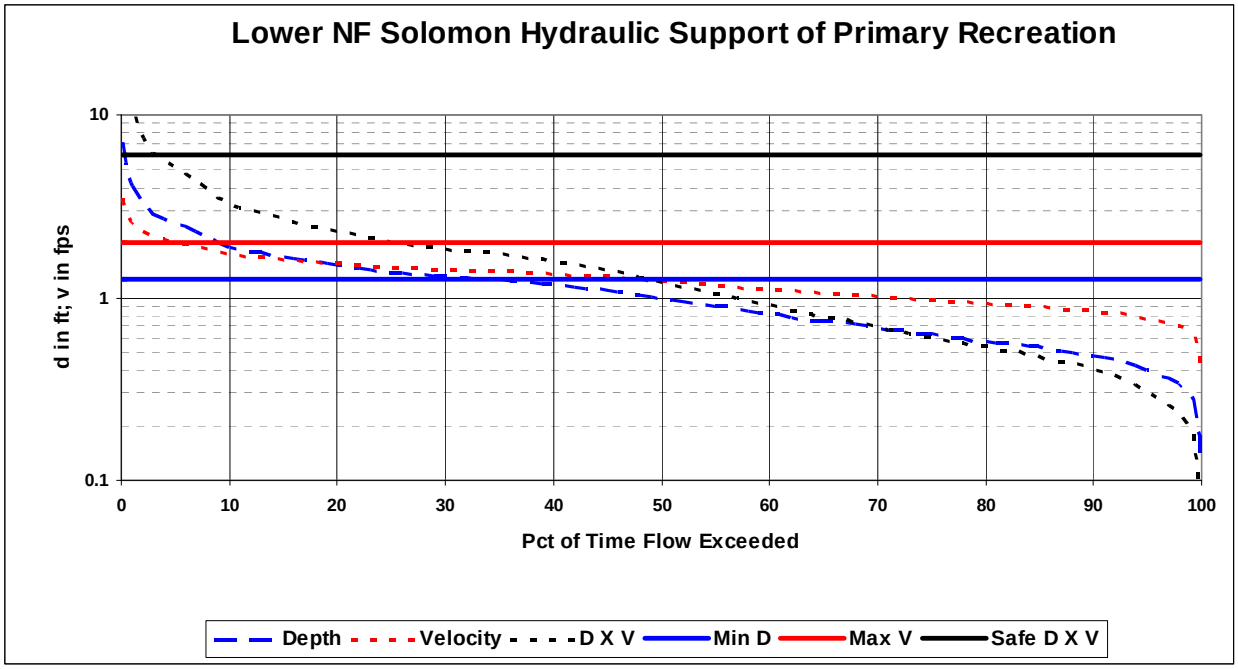

Figure 16. Hydraulic Geometry Supporting Primary Recreation on North Fork Solomon River

3. SOURCE INVENTORY AND ASSESSMENT

Point Sources: There are a number of NPDES permitted facilities in the Lower North Fork Solomon Sub-basin (**Figure 17**), but only three potentially discharge to the surface waters of the North Fork above Station SC014 **(Table 3)**. The other facilities are industrial users, discharging process water, concrete plants and quarries and non-discharging municipalities and commercial entities; none who contribute bacteria from their wastewater. There are no MS4 stormwater permits.

The City of Phillipsburg has a mechanical activated sludge plant that discharges to Plotner Creek, a tributary to Deer Creek. The plant utilizes ultraviolet irradiation to disinfect its wastewater. Phillipsburg monitors for bacteria monthly and since July 2008, has averaged 5 counts of bacteria in its effluent, never exceeding 22 counts. Phillipsburg has permit limits of 2358 counts for bacteria during primary recreation season.

The City of Smith Center uses a three-cell lagoon system to treat its wastewater. Disinfection occurs naturally with 120-days of retention before discharge. The wastewater flows down a

tributary to Beaver Creek. Treated wastewater can also be diverted to the municipal golf course for irrigating landscape. When wastewater is diverted to the golf course, its bacteria content is monitored and numerous conditions restricting the reuse of the effluent apply. Bacteria is monitored quarterly by the city. Since mid-2008, bacteria counts range from 10-85 during primary recreation season and 530-1020 during the off-season when secondary recreation is supported.

The City of Kensington also uses a three-cell lagoon with 120-days of retention to treat its wastewater. The designed volume of wastewater is quite low (0.055 MGD) and it is discharged to Middle Cedar Creek, coursing through Cedar Creek toward the North Fork. Reuse is allowed to irrigate surrounding croplands or grasslands. Among quarterly sampling periods, only one incident of discharge occurred and its bacteria content was low (10 counts).

The City of Downs has a three-cell lagoon that discharges 0.175 MGD into the North Fork Solomon below Station SC014. No limits are in place, but quarterly monitoring reveals that the bacteria in Downs' effluent range from 2 – 238 counts. Nonetheless, Downs' outfall is located below the impaired reach of the North Fork Solomon River and is not implicated as a cause.

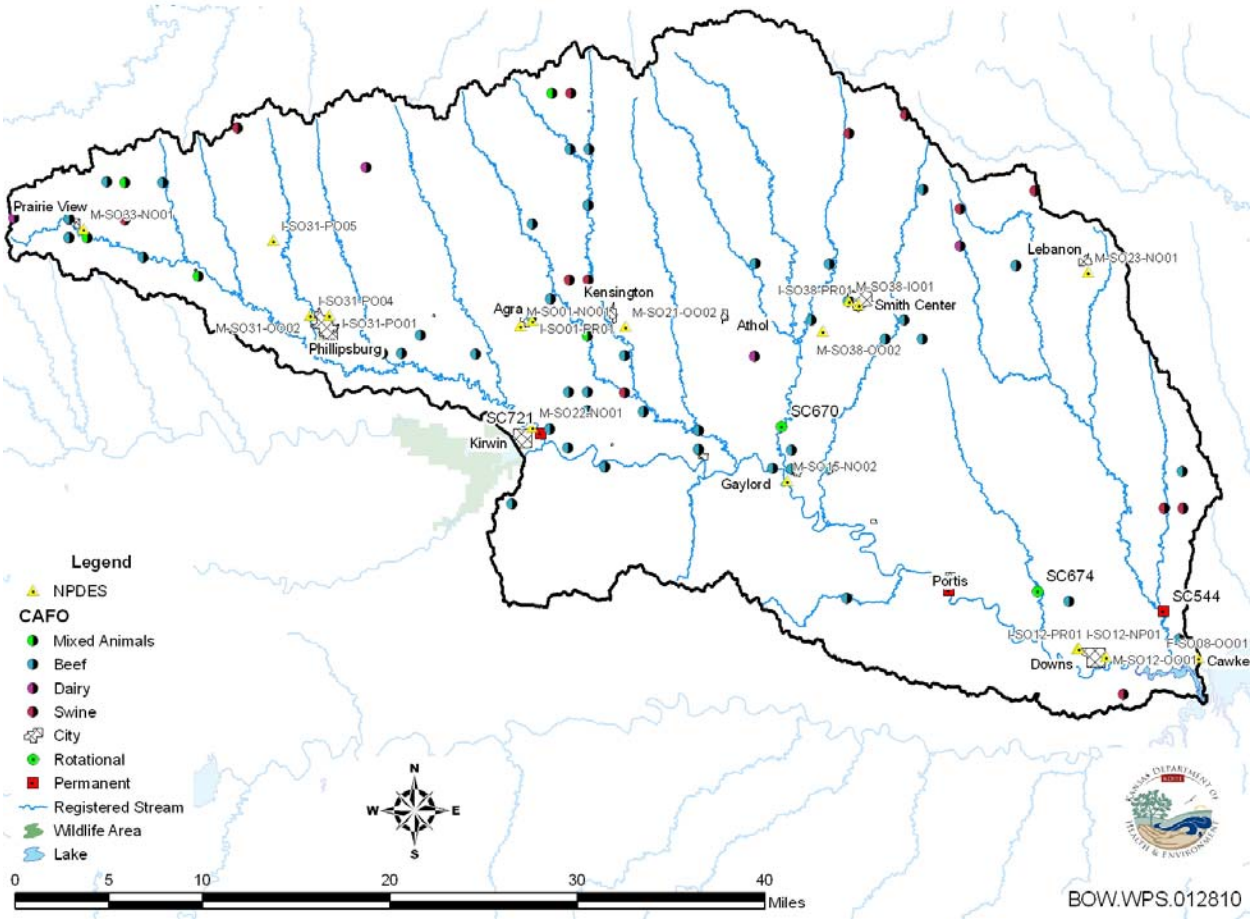

Figure 17. NPDES Facilities in the Lower North Fork Solomon Sub-basin

Table 3. Bacteria Discharging NPDES Facilities in Lower North Fork Solomon Subbasin

Facility	NPDES#	KS Permit #	Type	Rec Stream	Design Q (MGD)	Permit Expires
City of Phillipsburg WWTP	KS0097331	M-SO31-PO04	Activated Sludge	Plotner Creek to Deer Creek	0.50	9/30/2014
City of Smith Center WWTP	KS0098221	M-SO38-OO02	3-Cell Lagoon	Beaver Creek	0.28	12/31/2009
City of Kensington WWTP	KS0093998	M-SO21-OO02	3-Cell Lagoon	Middle Cedar Creek to Cedar Creek	0.055	9/30/2014
City of Downs WWTP	KS0098230	M-SO12-OO01	3-Cell Lagoon	North Fork Solomon River	0.175	12/31/2010
Mineral Right	KS0088277	I-SO31-PO04	Zeolite Wash Water	Plotner Creek	0.4608	11/30/2009
TAMKO	KS0001392	I-SO31-PO01	Asphalt Shingles-Holding Ponds	Ditch to Deer Creek	0.0869	9/30/2014
Coffeyville Resources	KS0089036	I-SO31-PO05	Remediation Project	Plotner Creek	0.1152	1/31/2014
B&B Redimix	KSG110067	I-SO31-PR01	Concrete Batch	Plotner Creek	0	9/30/2012
Shaw-Davis-Shaw (Agra)	KSG110153	I-SO01-PR01	Concrete Bacth	Turner Creek	0	9/30/2012
Shaw-Davis-Shaw (Smith Center)	KSG110154	I-SO38-PR01	Concrete Batch	Tributary to Spring Creek	0	9/30/2012
Abram Ready Mix	KSG110086	I-SO12-PR01	Concrete Batch	North Fork Solomon	0	9/30/2012
City of Prairie View	KSJ000282	M-SO33-NO01	Non-Q	Deer Creek	0	5/31/2010
City of Agra	KSJ000300	M-SO01-NO01	Non-Q	Turner Creek	0	1/31/2015
City of Kirwin	KSJ000293	M-SO22-NO01	Non-Q	North Fork Solomon	0	1/31/2015
Hansen Scout Reservation	KSJ000157	C-SO22-NO01	Non-Q	North Fork Solomon	0	12/31/2015
City of Gaylord	KSJ000306	M-SO15-NO02	Non-Q	Beaver Creek	0	1/31/2015
City of Lebanon	KSJ000294	M-SO23-NO01	Non-Q	Oak Creek	0	4/30/2015
Global Country of World Peace	KSJ000651	C-SO23-NO01	Non-Q	Oak Creek	0	9/30/2014
Downs Industrial Park	KSJ000157	I-SO12-NP01	Non-Q	North Fork Solomon	0	12/31/2012

Livestock Waste Management Systems: Fifty-seven operations, potentially holding 36,049 animals units, are registered, certified or permitted within the watershed. These facilities (beef, dairy or swine) are primarily located in the Deer Creek (16-10,105 AUs) or Cedar Creek (19-15,926 AUs) subwatersheds (**Figure 17**). Forty-six of the facilities in the watershed are beef operations (totaling 27,983 animal units), seven are swine (7044 AUs) and four are dairies (1022 AUs). Three of the facilities are NPDES permitted, non-discharging facilities with 8300 animal units.

Another three facilities (**Figure 17**) lie below SC014 and are permitted for 1225 animal units (400 swine, 825 beef). Those facilities would not influence the bacteria levels found at SC014 that were the impetus for this TMDL, but they could impact recreation use on the lowest reaches of the North Fork as it enters Waconda Lake. Livestock facilities within the Oak Creek subwatershed were not considered or accounted since Oak Creek joins the North Fork within the headwaters of Waconda Lake. Actual number of animal units on site is variable, but is typically less than potential numbers.

All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed to retain the 25 year, 24 hour rainfall/runoff event, as well as an anticipated two weeks of normal wastewater from their operations. Such a rainfall event typically coincides with stream flows which are exceeded 1-5 percent of the time. Therefore, events of this type, infrequent and of short duration, are not likely to add to chronic impairment of the designated uses of the waters in this watershed. Requirements for maintaining the water level of the waste lagoons at a certain distance below the lagoon berms ensure retention of the runoff from the intense, local storms events. In Phillips and Smith counties, such events total 4.8 – 5.0 inches in 24 hours, generating 3.7 – 3.9 inches of runoff off low permeable surfaces.

Land Use: Most of the watershed is grassland (40.1%) or cropland (52.7% of the area). Developed land comprises 1.4% of the watershed. These proportions are similar whether looking at the entire watershed between Waconda and Webster or just the subwatersheds above Station SC014 (**Figure 18**), albeit a slight increase in cropland below SC014 with concurrent decreased proportion of grassland. Most of the cropland is located in the alluvial valleys of the North Fork or its tributaries or in irrigation district service areas and in proximity to the headwaters of Waconda Lake. Grassland is prevalent in the southern portions of the sub basin and the upper headwaters of the subwatersheds. The six sub-watersheds with greater than 50% grassland are certain tributaries of Deer Creek in Phillips County and the upper drainages of Beaver Creek in Smith County. The nine subwatersheds with 60% cropland or greater are the North Fork valley below Portis and Twelvemile Creek in Osborne County and the lower drainages of Cedar and Beaver Creeks in Smith County. Livestock may be grazed on the grassland areas or on the harvested cropland areas.

Table 4. Permitted Livestock Operations in Lower North Fork Solomon River Subbasin

Facilities located above Station SC014 at Portis					
County	**HUC10/12**	**KS Permit#**	**Permit Type**	**Fed AU**	**Type**
Phillips	***0101***	A-SOPL-B001	Permit	999	Beef, Swine
		A-SOPL-B009	Permit	990	Beef
		A-SOPL-S015	Permit	200	Swine
		A-SOPL-B011	Permit	999	Beef
		A-SOPL-MA01	Certification	70	Dairy
		A-SOPL-B005	Permit	300	Beef
		A-SOPL-B004	Permit	200	Beef
		A-SOPL-B012	Permit	220	Beef, Sheep
	0102	A-SOPL-B006	Permit	800	Beef
		A-SOPL-BA12	Certification	71.2	Beef, Swine
		A-URPL-H008	NPDES Permit*	3072	Swine
	0104	A-SOPL-BA13	Certification	100	Beef
		A-SOPL-B010	Permit	900	Beef
	0105	A-SOPL-M003	Permit	285	Dairy
		A-SOPL-BA11	Certification	399	Beef
	0106	A-SOPL-BA02	Certification	500	Beef
	0201	A-SOPL-BA01	Certification	800	Beef
		A-SOPL-BA03	Certification	950	Beef
		A-SOPL-BA07	Certification	340	Beef
	0203	A-SOPL-B002	Permit	980	Beef
		A-SOPL-B008	Permit	300	Beef
		A-SOPL-BA09	Certification	125	Beef
		A-SOPL-BA06	Certification	280	Beef
	0204	A-SOPL-C001	NPDES Renewal**	3150	Beef
		A-SOPL-B014	Permit	335	Beef, Dairy
		A-SOPL-H002	NPDES Permit***	2080.4	Swine
	0206	A-SOPL-S030	Permit	636.8	Swine
Smith	***0201***	A-SOSM-B002	Permit	300	Beef
		A-SOSM-BA01	Certification	650	Beef
		A-SOSM-BA09	Certification	200	Beef
	0203	A-SOSM-BA10	Certification	999	Beef, Swine
		A-SOSM-BA07	Certification	999	Beef
		A-SOSM-B017	Permit	990	Beef
	0204	A-SOSM-M002	Permit	625	Dairy
		A-SOSM-B011	Permit	950	Beef
		A-SOSM-B019	Permit	800	Beef
	0206	A-SOSM-BA11	Certification	165	Beef
		A-SOSM-S003	Permit Renewal	560.8	Swine
	0207	A-SOSM-B004	Permit	950	Beef
		A-SOSM-B009	Permit	900	Beef
		A-SOSM-BA08	Certification	100	Beef
NPDES #'s: *KS0096091 **KS0090484 ***KS0082198					

Table 4, cont'd.

County	HUC10/12	KS Permit#	Permit Type	Fed AU	Type
Smith	***0303***	A-SOSM-BA04	Certification	300	Beef
	0304	A-SOSM-B021	Permit	999	Beef
		A-SOSM-SA08	Certification	160	Swine
	0305	A-SOSM-MA01	Certification	42	Dairy
		A-SOSM-C166	Permit	400	Beef
		A-SOSM-B016	Permit	5	Beef
		A-SOSM-BA12	Certification	240	Beef
	0306	A-SOSM-S008	Permit	334	Swine
		A-SOSM-BA13	Certification	40	Beef
		A-SOSM-B012	Permit	700	Beef
	0307	A-SOSM-BA02	Certification	200	Beef
		A-SOSM-B020	Permit	999	Beef
		A-SOSM-B008	Permit	500	Beef
	0308	A-SOSM-BA15	Certification	300	Beef
	0309	A-SOSM-BA14	Certification	560	Beef
Osborne	***0310***	A-SOOB-B013	Permit	999	Beef
Facilities located below Station SC014 at Portis					
Osborne	***0403***	A-SOOB-BA13	Certification	600	Beef
	0409	A-SOOB-SA01	Certification	400	Swine
Mitchell	***0409***	A-SOMC-BA13	Certification	225	Beef

On-site Waste Systems: Thirty-four to 44% of the population in Smith and Phillips Counties use septic systems. The population density is low for Smith and Phillips counties (5.1 – 6.8 people/mi^2). Estimated 2008 populations for the two counties indicate declines since 2000 of -12.1% (Phillips) and -17.3% (Smith). All of the towns in the watershed saw declines between 2000 and 2008: -11.3% for Phillipsburg; -14.9% for Smith Center; -12.3% for Kensington; -14.9% for Downs; -12.2% for Portis; -12.1% for Agra; -17.2% for Gaylord; -9.6% for Kirwin; -9.9% for Prairie View; and -15.4% for Cedar. The population of the unicorporated areas in the watershed will use on-site waste systems, but it is declining with time. Additionally, the number of failing systems will likely diminish through efforts of the Local Environmental Protection Program and by their low volume nature, only such failing systems close to the streams will likely have an impact on ambient stream water quality.

Contributing Runoff: The Lower North Fork Solomon River watershed's average soil permeability is 1.2 inches/hour according to NRCS STATSGO database. Practically all the watershed produces runoff even under relatively low (1.71"/hr) potential runoff conditions (99.0%). Under very low (1.14"/hr) potential conditions, this potential contributing area is reduced to about 33.5%. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.57"/hr of rain will only generate runoff from 2.6% of this watershed, in the vicinity of stream channels.

Background Levels: Some contributions from wildlife, but it is likely that the density of animals such as deer is fairly dispersed across the watershed resulting in minimal loading to the streams below the levels necessary to violate the water quality standards.

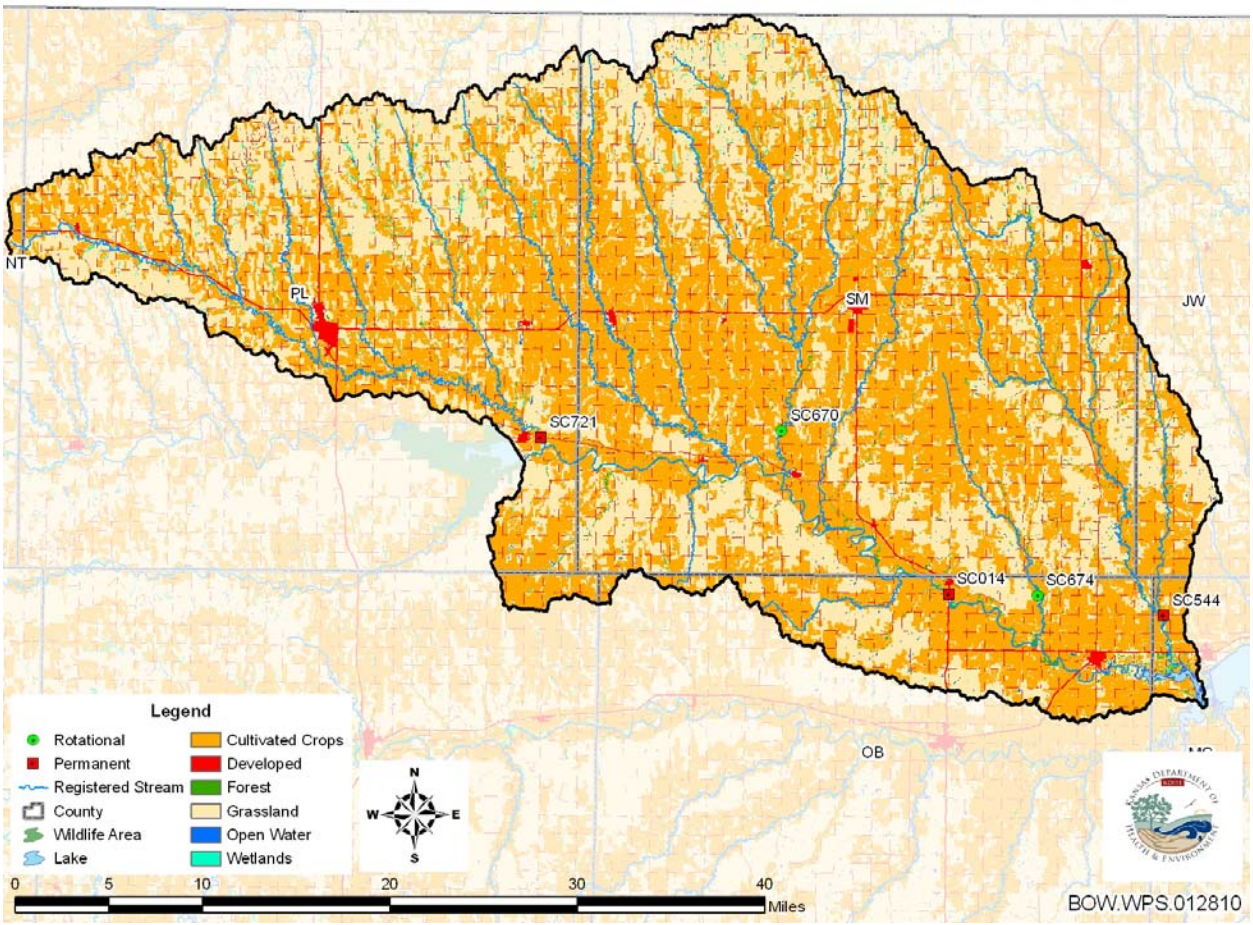

Figure 18. Land Use on the Lower North Fork Solomon River

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

This TMDL will be established to meet the primary recreation season geometric mean of bacteria counts for the North Fork Solomon River at Portis.. For Segment 7, as monitored by SC014, the geometric mean of five samples taken in 30 days should be below 427 counts during April thru October. While the legal determination of attainment is geometric means below the criterion, this TMDL will look to reduce the duration, frequency and magnitude of individual E coli samples taken during the primary recreation season such that a majority will be below the nominal value of the criterion. **Figure 8** displays the distribution of KDHE samples taken since 2003 over flow conditions. Lower flows dominate the periods of KDHE sampling, so the current condition lacks definition in the upper flow range. Excessively high flows have not been encountered in KDHE sampling, so the current condition is restricted to lower flows. Moreover, the hydraulic geometry of North Fork is fairly restricted for favorable conditions to support primary recreation during higher flows. Nonetheless, pooled areas during lower flows provide opportunities for primary recreation and should be devoid of excessive bacteria.

Table 5 displays the total Load Capacity, Wasteload Allocations and Load Allocations for the Lower North Fork Solomon River in the vicinity of Portis down to the confluence with Twelvemile Creek. **Appendix C** provides the calculations for these daily loads of bacteria.

Table 5. Total Load Capacity, Wasteload Allocations & Load Allocations for Lower North Fork ECB

Flow Percentile	Portis Flow	Portis LC	Portis WLA	Portis LA
90%	8.5 cfs	95.0 Gc/d	74.5 Gc/d	20.5 Gc/d
75%	16 cfs	173.3 Gc/d	74.5 Gc/d	98.8 Gc/d
50%	45 cfs	476.1 Gc/d	74.5 Gc/d	401.6 Gc/d
25%	97 cfs	1019 Gc/d	74.5 Gc/d	944.5 Gc/d
10%	203 cfs	2126 Gc/d	74.5 Gc/d	2051 Gc/d

Point Sources: In accordance with The Surface Water Quality Standards at K.A.R.28-16-28e(c)(7)(F), "Wastewater effluent shall be disinfected if it is determined by the department that the discharge of non-disinfected wastewater constitutes an actual or potential threat to public health". Therefore, wastewater discharged by Phillipsburg will be disinfected, while the three lagoon systems at Kensington, Smith Center and Downs should have sufficient retention time prior to discharge to ensure bacteria die-off.

The Wasteload Allocations will reflect either applicable permit limits of colonies (or counts) of bacteria per 100 ml or expected levels of bacteria discharged by lagoons (**Table 6**). For all four dischargers, the nominal limit will be 2358 counts/100 ml, which is the existing limit for Phillipsburg. While the lagoon systems have no permit limits for E coli bacteria, their Wasteload allocation will assume they need to have monthly geometric means of 2358 counts, reflecting the recreation designation of the stream segments to which they discharge and their potential impact to Segment 7 and Waconda Lake. Non-discharging facilities such as Agra and Gaylord will have Wasteload allocations of zero as will the other industrial dischargers who do not have bacteria in their wastewater. The confined animal feeding operations will have Wasteload allocations of zero, as well, because all of these facilities should not discharge to the North Fork.

All four dischargers have effluent with consistently low E coli bacteria with values lying far below the nominal limit used in their Wasteload Allocations. Therefore, Wasteload Allocations for these dischargers would be based initially on adherence to their existing permit limits or expected performance (**Table 6**). If any discharger is shown to be causing the high bacteria levels at Portis, subsequent adjustment and more stringent permit requirements will be made to their NPDES permit.

Table 6. Wastewater Permits and E coli Bacteria WLAs for North Fork Solomon River

Facility	Design Q	E coli Bacteria Existing or Expected Limit	Wasteload Allocation (giga-colonies/day)
Phillipsburg	0.5 MGD (0.77 cfs)	2358 col/100ml	44.6
Kensington	0.055 MGD (0.09 cfs)	2358 col/100 ml	4.9
Smith Center	0.28 MGD (0.43 cfs)	2358 col/100 ml	25.0
Total	0.835 MGD (1.29 cfs)		74.5

Nonpoint Source: The Load Allocation (LA) assigns responsibility for nonpoint source contributors for the bacteria input into the North Fork, particularly from the tributaries. The Load Allocation for the North Fork in **Appendix C** would be determined from the remaining load from the total load capacity after accounting for the Wasteload Allocations. While the recreation support on the tributaries is limited to secondary contact, the tributary contributions are chiefly responsible for the elevated bacteria concentrations seen at Portis. Loadings as runoff increases appear to cause many of the bacteria digressions at Portis, therefore, the emphasis on this TMDL will be abatement of non-point source contributions, particularly along the tributaries.

Progress will be determined by reduction in the Portis ECB index profile, along with those for Deer Creek and Beaver Creek as indicated in **Figure 13**. As the tributary profiles decline, intensive sampling during the primary contact recreation season along the main stem should ensue to assess whether the water quality standards are now being achieved on the North Fork.

Defined Margin of Safety: The Margin of Safety provides some hedge against the uncertainty in bacteria loading into North Fork, predominantly from wet weather sources in the watershed. This TMDL uses an implicit margin of safety, relying on conservative assumptions tied to assessing attainment to the primary recreation Class C criterion (427 colonies/ 100 ml). First, wasteload allocations are assigned to all four dischargers, regardless of location relative to Segment 7 based on a value that is more stringent than the applicable criterion for their receiving segment. Second, there is assumed no die off of bacteria between their outfalls and Portis. Third, they are assumed to discharge at design flows when demographic information indicates that their future wasteloads may actually decline. Fourth, in actuality, their bacteria content of their wastewater is an order of magnitude or two below the applicable criterion. Finally, even though portions of the primary recreation season has hydrologic conditions that do not provide enough depth to support primary recreation, the primary recreation criteria will be applied as endpoints for this TMDL at any flow condition throughout April to October across the entire watershed.

State Water Plan Implementation Priority: Due to the isolated reach designated for primary recreation on the North Fork, this TMDL will be designated as a **Medium Priority** for implementation to abate non-point source contribution of bacteria, unless any implementation effort is in concert with attempts to reduce sediment and nutrient loading to Waconda Lake.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Lower North Fork Solomon Basin (HUC 8: 10260012) with a priority ranking of 34 (Medium Priority for restoration work).

Priority HUC 10s and Stream Segments: Initial focus of implementation should concentrate on riparian grazing activities along Deer Creek below Phillipsburg, and the lower reaches of Cedar and Beaver Creek watersheds (102600120105 & 06; 102600120203, 06 & 07; and 102600120305, 07, 08 & 09).

5. IMPLEMENTATION

Desired Implementation Activities

1. Maintain disinfection operations under state and federal permits, inspect permitted facilities, continue monitoring requirements and evaluate compliance with permit limits.
2. Improve riparian conditions along stream systems by limiting overuse from grazing livestock along the stream.
3. Provide alternative water supplies for livestock to limit their use of streams as water sources.
4. Ensure land applied manure is being properly managed and is not susceptible to runoff into nearby streams.
5. Install pasture management practices, including proper stock density to reduce soil erosion and storm runoff.
6. Ensure proper on-site waste system operations in proximity to the main stream segments.

Implementation Programs Guidance

NPDES and State Permits - KDHE

a. Monitor effluent from the discharging permitted wastewater treatment facilities, continue to encourage wastewater reuse and ensure compliance and proper operation to control bacteria in wastewater discharges.
b. Inspect and verify that facilities designed not to discharge to the North Fork or its tributaries have no wastewater leaving their facililities.
c. Maintain permit limits after 2014 and operation of disinfection techniques.
d. Inspect permitted livestock facilities to ensure compliance.
e. New Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
f. New Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
g. Manure management plans will be implemented, to include proper land application rates and practices that will prevent runoff of applied manure.

Nonpoint Source Pollution Technical Assistance – KDHE

a. Support Section 319 demonstration projects for reduction of bacteria loading from agricultural lands though livestock management.
b. Provide technical assistance on practices geared to the establishment of vegetative buffer strips.
c. Provide technical assistance on bacteria management for livestock facilities in the watershed and practices geared toward small livestock operations which minimize impacts to stream resources.
d. Support Watershed Restoration and Protection Strategy (WRAPS) efforts for the Waconda Lake and incorporate long term objectives of this TMDL into their 9-element watershed plan

Water Resource Cost Share and Nonpoint Source Pollution Control Program – SCC

a. Install livestock waste management systems for manure storage.
b. Implement manure management plans.
c. Support terracing, grass waterways and buffers along cropland
d. Repair or replace failing septic systems which are located within 100 feet of the Lower North Fork or its tributaries.

Riparian Protection Program – SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and stream bank vegetation.
b. Develop riparian restoration projects along targeted stream segments, particularly lower Deer Creek and Cedar and Beaver Creeks.

Buffer Initiative Program – SCC

a. Install grass buffer strips near North Fork and tributary streams.
b. Mitigate removal of riparian lands from Conservation Reserve Program to hold streamside land out of production.

Extension Outreach and Technical Assistance – Kansas State University

a. Educate agricultural producers on sediment, nutrient, bacteria and pasture management.
b. Educate livestock producers on livestock waste management and land applied manure applications.
c. Provide technical assistance on livestock waste management systems.
d. Provide technical assistance on buffer strip design and minimizing rural runoff.
e. Educate residents, landowners, and watershed stakeholders about homestead waste management.
f. Promote and utilize Waconda Lake WRAPS efforts at pollution prevention, runoff control and resource management.

Timeframe for Implementation: Rural runoff management should commence in 2010 on the three priority tributaries of North Fork. Implementation of abatement practices should commence in the priority watersheds in 2011. Implementation should continue through 2019.

Targeted Participants: The primary participants for implementation will be the agricultural and livestock operations immediately adjacent to the lower portions of North Fork Solomon River and tributaries within the priority sub watersheds. All will be encouraged to implement appropriate practices. Watershed coordinators and technical staff of the WRAPS, along with Conservation District personnel and county extension agents should assess possible sources adjacent to the streams over 2010 - 2011. Non-point source implementation activities should focus on those areas with the greatest potential to impact bacteria concentrations along the North Fork tributaries.

Targeted activities to focus attention toward include:

1. Overused grazing land adjacent to the stream.
2. Sites where drainage runs through or adjacent to livestock areas.
3. Sites where livestock have full access to the stream and it is their primary water supply.
4. Poor riparian area and denuded riparian vegetation along the stream.

Milestone for 2014: In accordance with the TMDL development schedule for the State of Kansas, the year 2014 marks the next cycle of 303(d) activities in the Solomon Basin. Because bacteria daily loads are nonsensical, at that point in time, bacteria profiles from site SC014 and the Deer and Beaver Creek stations should show indications of declining concentrations relative to those seen upstream at site SC541.

Therefore, the station at Portis will need to see reductions in duration, frequency and magnitude of future E coli bacteria samples and see its index profile approach that of an idealized profile shown in **Figure 13**. When evidence of these reductions occurs, intensive sampling during the primary recreation season will be done to ascertain whether those geometric means are in compliance with the bacteria criterion.

Delivery Agents: The primary deliver agents for program participation will be KDHE, the Waconda Lake WRAPS, the Phillips and Smith County Conservation Districts for programs of the State Conservation Commission.

Reasonable Assurances:
Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution:

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.S.A. 2002 Supp. 82a-2001 identifies the classes of recreation use and defines impairment for streams.

4. K.A.R. 28-16-69 through 071 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

5. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

6. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

7. K.S.A. 82a-901, et. seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

8. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*, including selected Watershed Restoration and Protection Strategies.

9. The Kansas Water Plan and the Solomon River Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic area of the state for high priority in implementation.

Funding: The State Water Plan annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watershed and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are located within a **Medium Priority** WRAPS area and should receive support for pollution abatement practices if lowering the loading of bacteria also lowers the associated pollutants of sediment and nutrients to Waconda Lake.

Effectiveness: Use of retention and buffers that isolate streams from nearby uses and potential loadings has been effective in reducing the bacteria levels in streams, including under wet weather conditions. In addition, the proper implementation of comprehensive livestock waste management plans has proven effective at reducing runoff associated with livestock facilities.

6. MONITORING

KDHE will continue to collect quarterly to bimonthly samples in every year at Stations SC014 and SC721. Sampling can be expected at Station SC670 in 2012, 2016 and 2020. Based on the sampling data, the priority status of the 303(d) listing will be evaluated in 2014. The stream will be evaluated for possible delisting in 2020. Additional monitoring on the tributaries and on the reaches below Portis to ascertain bacteria contribution reductions and attainment of recreation support along the North Fork Solomon.

7. FEEDBACK

Public Notice: An active Internet Web site was established at www.kdheks.gov/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Solomon Basin.

Public Hearing: A Public Hearing on this TMDL was held on February 10, 2010 in Phillipsburg to receive comments on this TMDL.

Basin Advisory Committee: The Solomon River Basin Advisory Committee met to discuss the TMDLs in the basin on July 7, 2009 in Stockton and September 30, 2009 in Stockton and again on March 2, 2010 in Beloit.

Watershed Restoration and Protection Strategy Group: This TMDL has been reviewed in February, 2010 by the Waconda Lake WRAPS group.

Milestone Evaluation: In 2014, evaluation will be made as the degree of implementation which has occurred within the watershed. Subsequent decisions will be made regarding the implementation approach, priority of allotting resources for implementation and the need for additional or follow up implementation in this watershed at the next TMDL cycle for this basin in 2014 with consultation from local stakeholders and WRAPS teams.

Consideration for 303(d) Delisting: The North Fork Solomon River will be evaluated for delisting under section 303(d), based on the monitoring data over 2010-2019. Therefore, the decision for delisting will come about in the preparation of the 2020-303(d) list. Should modifications be made to the applicable water quality criteria during the implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities might be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality, Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision would come in 2010, which will emphasize implementation of WRAPS activities. At that time, incorporation of this TMDL will be made into the WRAPS. Recommendations of this TMDL will be considered in the Kansas Water Plan implementation decisions under the State Water Planning Process for Fiscal Years 2010-2019.

Revised February 3, 2011

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Stiles, T.C. & M.B.Tate, 2008. Managing bacteria TMDLs by overlaying water quality, hydrology and corrective measures on stream recreation. Water Practice 2: 1-13.

Appendix A. K.S.A. 82a-2001, et seq: Classified stream segments defined; other definitions. As used in this act:

(7) (A) "Recreational use" means:

(i) Primary contact recreational use is use of a classified stream segment for recreation during the period from April 1 through October 31 of each year, provided such classified stream segment is capable of supporting the recreational activities of swimming, skin diving, water skiing, wind surfing, kayaking or mussel harvesting where the body is intended to be immersed in surface water to the extent that some inadvertent ingestion of water is probable.

(a) Primary contact recreational use-Class A: Use of a classified stream segment for recreation during the period from April 1 through October 31 of each year, and the classified stream segment is a designated public swimming area. Water quality criterion for bacterial indicator organisms applied to Class A waters shall be set at an illness rate of eight or more per 1000 swimmers. The classified stream segment shall only be considered impaired for primary contact recreational use-Class A if the calculated geometric mean of at least five samples collected in separate 24-hour periods within a 30-day period exceeds the corresponding water quality criterion. The water quality criterion for primary contact recreational use-Class A waters during the period November 1 through March 31 of each year shall be equal to the criterion applied to secondary contact recreational use-Class A waters.

(b) Primary contact recreational use-Class B: Use of a classified stream segment for recreation, where moderate full body contact recreation is expected, during the period from April 1 through October 31 of each year, and the classified stream segment is by law or written permission of the landowner open to and accessible by the public. Water quality criterion for bacterial indicator organisms applied to Class B waters shall be set at an illness rate of 10 or more per 1000 swimmers. The classified stream segment shall only be considered impaired for primary contact recreational use-Class B if the calculated geometric mean of at least five samples collected in separate 24-hour periods within a 30-day period exceeds the corresponding water quality criterion. The water quality criterion for primary contact recreational use-Class B waters during the period November 1 through March 31 of each year shall be equal to the criterion applied to secondary contact recreational use-Class A waters.

(c) Primary contact recreational use-Class C: Use of a classified stream segment for recreation, where full body contact recreation is infrequent during the period from April 1 through October 31 of each year, and is not open to and accessible by the public under Kansas law and is capable of supporting the recreational activities of swimming, skin diving, water-skiing, wind surfing, boating, mussel harvesting, wading or fishing. Water quality criterion for bacterial indicator organisms applied to Class C waters shall be set at an illness rate of 12 or more per 1000 swimmers. The classified stream segment shall only be considered impaired for primary contact recreational use-Class C if the calculated geometric mean of at least five samples collected in separate 24-hour periods within a 30-day period exceeds the corresponding water quality criterion. The water quality criterion for primary contact recreational use-Class C waters during the period November 1 through March 31 of each year shall be equal to the criterion applied to secondary contact recreational use-Class B waters.

(ii) Secondary contact recreational use is use of a classified stream segment for recreation, provided such classified stream segment is capable of supporting the recreational activities of

wading, fishing, canoeing, motor boating, rafting or other types of boating where the body is not intended to be immersed and where ingestion of surface water is not probable.

(a) Secondary contact recreational use-Class A: Use of a classified stream segment for recreation capable of supporting the recreational activities of wading or fishing and the classified stream segment is by law or written permission of the landowner open to and accessible by the public. Water quality criterion for bacterial indicator organisms applied to secondary contact recreational use-Class A waters shall be nine times the criterion applied to primary contact recreational use-Class B waters. The classified stream segment shall only be considered impaired for secondary contact recreational use-Class A if the calculated geometric mean of at least five samples collected in separate 24-hour periods within a 30-day period exceeds the corresponding water quality criterion.

(b) Secondary contact recreational use-Class B: Use of a classified stream segment for recreation capable of supporting the recreational activities of wading or fishing and the classified stream segment is not open to and accessible by the public under Kansas law. Water quality criterion for bacterial indicator organisms applied to secondary contact recreational use- Class B waters shall be nine times the criterion applied to primary contact recreational-Class C use waters. The classified stream segment shall only be considered impaired for secondary contact recreational use-Class B if the calculated geometric mean of at least five samples collected in separate 24-hour periods within a 30-day period exceeds the corresponding water quality criterion.

(B) If opposite sides of a classified stream segment would have different designated recreational uses due to differences in public access, the designated use of the entire classified stream segment may be the higher attainable use, notwithstanding that such designation does not grant the public access to both sides of such segment.

(C) Recreational use designations shall not apply to stream segments where the natural, ephemeral, intermittent or low flow conditions or water levels prevent recreational activities.

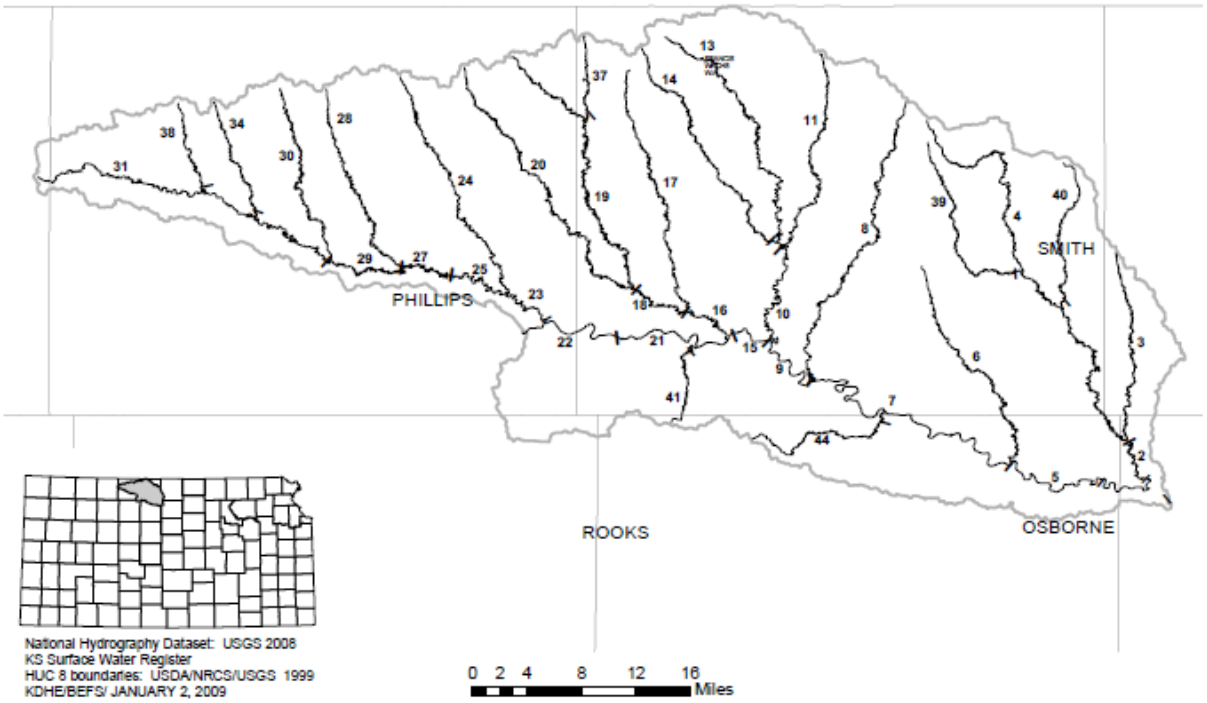
(d) "Ephemeral stream" means streams that flow only in response to precipitation and whose channel is at all times above the water table.

(e) "Secretary" means the secretary of health and environment.

History: L. 2001, ch. 100, § 1; L. 2003, ch. 105, § 1; May 1.

Appendix B. Classified Streams of the Lower North Fork Solomon River Basin

SOLOMON RIVER BASIN
SUBBASIN: LOWER NORTH FORK SOLOMON (HUC 10260012)



Appendix C. Calculation of Load Capacity and Allocations for Bacteria on North Fork Solomon

1. For each representative flow condition, the flow at the Portis (06872500) gage was used to establish the base condition; including the current wastewater volumes from Phillipsburg, Kensington and Smith Center, presuming those flows made it to Portis.

2. A current wastewater flow of 0.69 cfs was assumed to exist based on current populations of the three cities.

3. Additional flow was computed as the difference between the design flow and the current flow from the three cities, this was added to the Portis flow.

4. The Portis Load Capacity was calculated as the New Portis flow times the Primary C criterion of 427 counts per 100 ml times the conversion factor (0.0244512) to derive Giga-colonies per day of bacteria.

5. The Wasteload Allocation was calculated as the three cities' design flow times 2358 counts/100 ml times the conversion factor

6. The Load Allocation was calculated as the difference between the Load Capacity and the Wasteload Allocation.

Flow Condition	Portis Flow	current ww flow	additional ww flow	New Portis Q	Portis LC	Portis WLA	Portis LA
90th	8.5 cfs	0.69 cfs	0.6 cfs	9.1 cfs	95.0 Gc/d	74.5 Gc/d	20.5 Gc/d
75th	16 cfs	0.69 cfs	0.6 cfs	16.6 cfs	173.3 Gc/d	74.5 Gc/d	98.8 Gc/d
50th	45 cfs	0.69 cfs	0.6 cfs	45.6 cfs	476.1 Gc/d	74.5 Gc/d	401.6Gc/d
25th	97 cfs	0.69 cfs	0.6 cfs	97.6 cfs	1019 Gc/d	74.5 Gc/d	944.5 Gc/d
10th	203 cfs	0.69 cfs	0.6 cfs	203.6 cfs	2126 Gc/d	74.5 Gc/d	2051 Gc/d