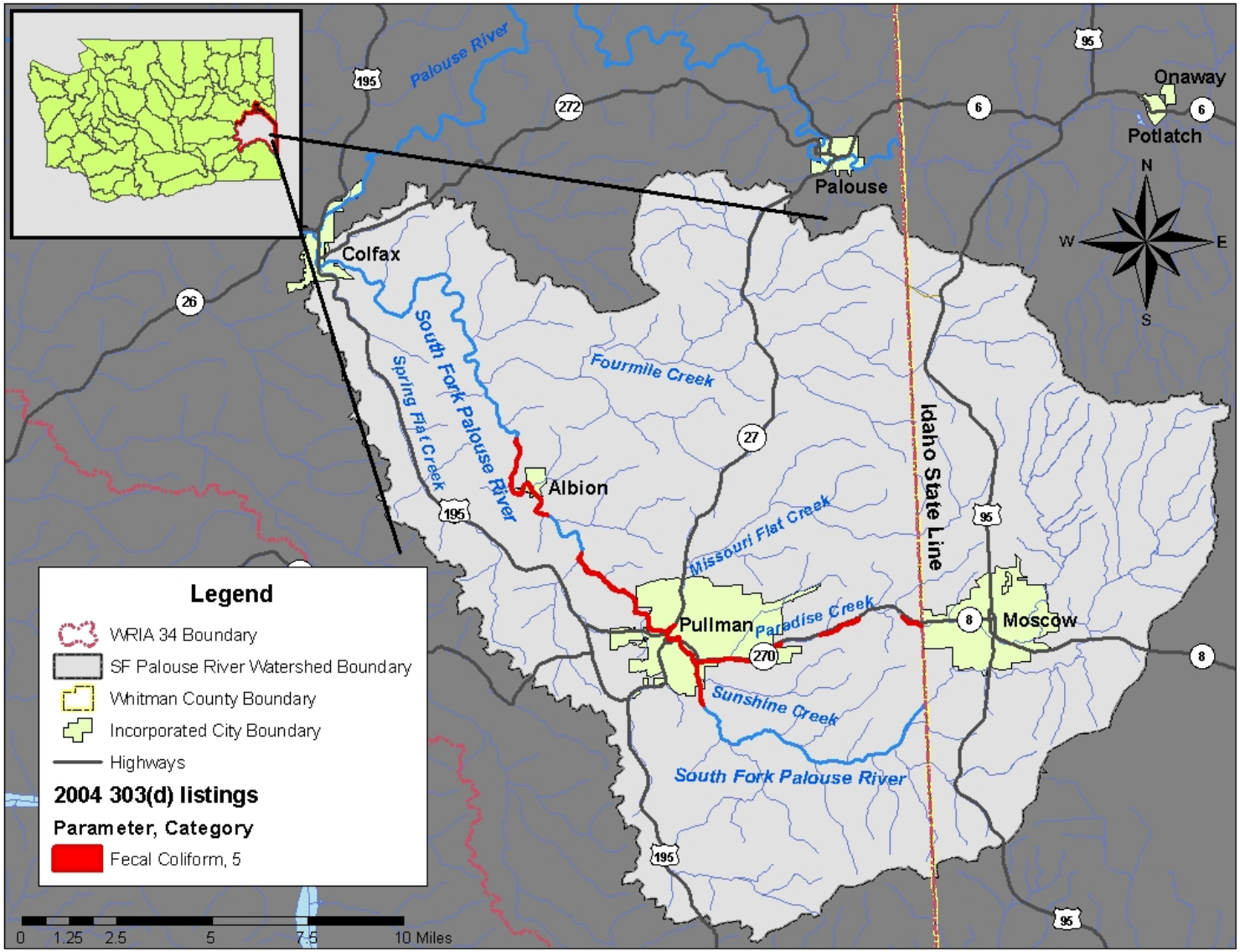
South Fork Palouse River Bacteria Loading Analysis*

Presented at July 9, 2008 & September 9, 2008

SFPR Water Quality Advisory Group Meetings

*Note: data contained within this presentation is considered preliminary.

S.F. Palouse River Basin 303(d)list Fecal Coliform Bacteria Listings



Fecal Coliform Bacteria Water Quality Standard for freshwater with primary contact recreation

1. A geometric mean less than 100 cfu/100 mL

2. And no more than 10% of samples > 200 cfu/100 mL

(same as the Class A designation in the old WAC)

1 teaspoon ≈ 65 million bacteria cells

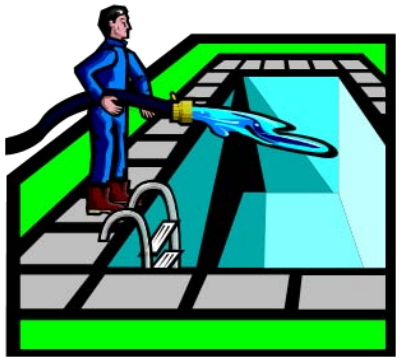
(13 million bacteria cells in 1 gram human feces) (5 milliliters in 1 teaspoon)

Cup

≅ 26 million cells / 100 mL

Bath tub

≅ 40,000 cells / 100 mL



Swimming pool

≅ 200 cells / 100 mL

Fecal Coliform Bacteria TMDL Study Goals for this year.

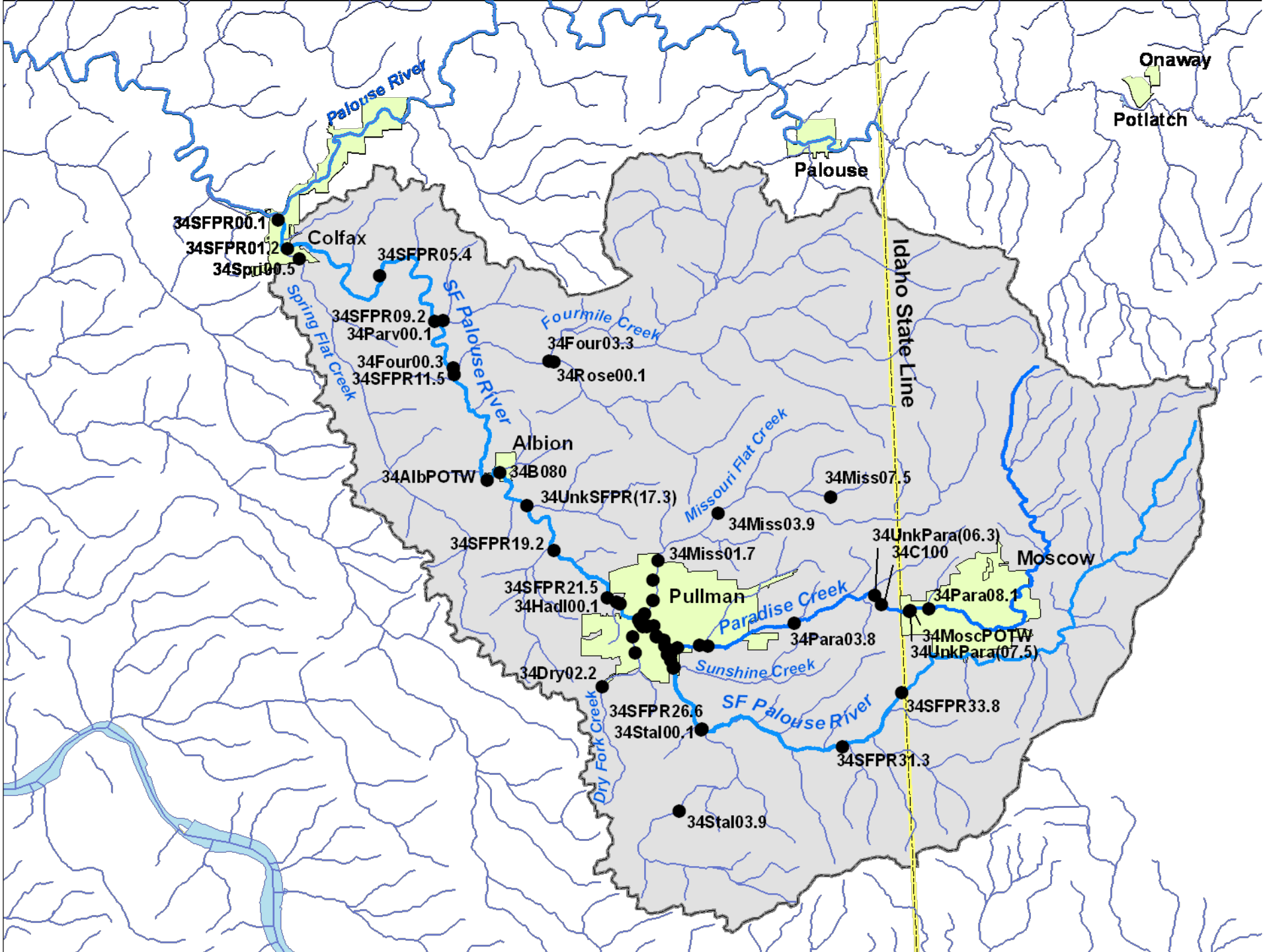
- Identify and characterize fecal coliform bacteria concentrations and loads from tributaries, point sources under various seasonal or hydrological conditions, including stormwater contributions.

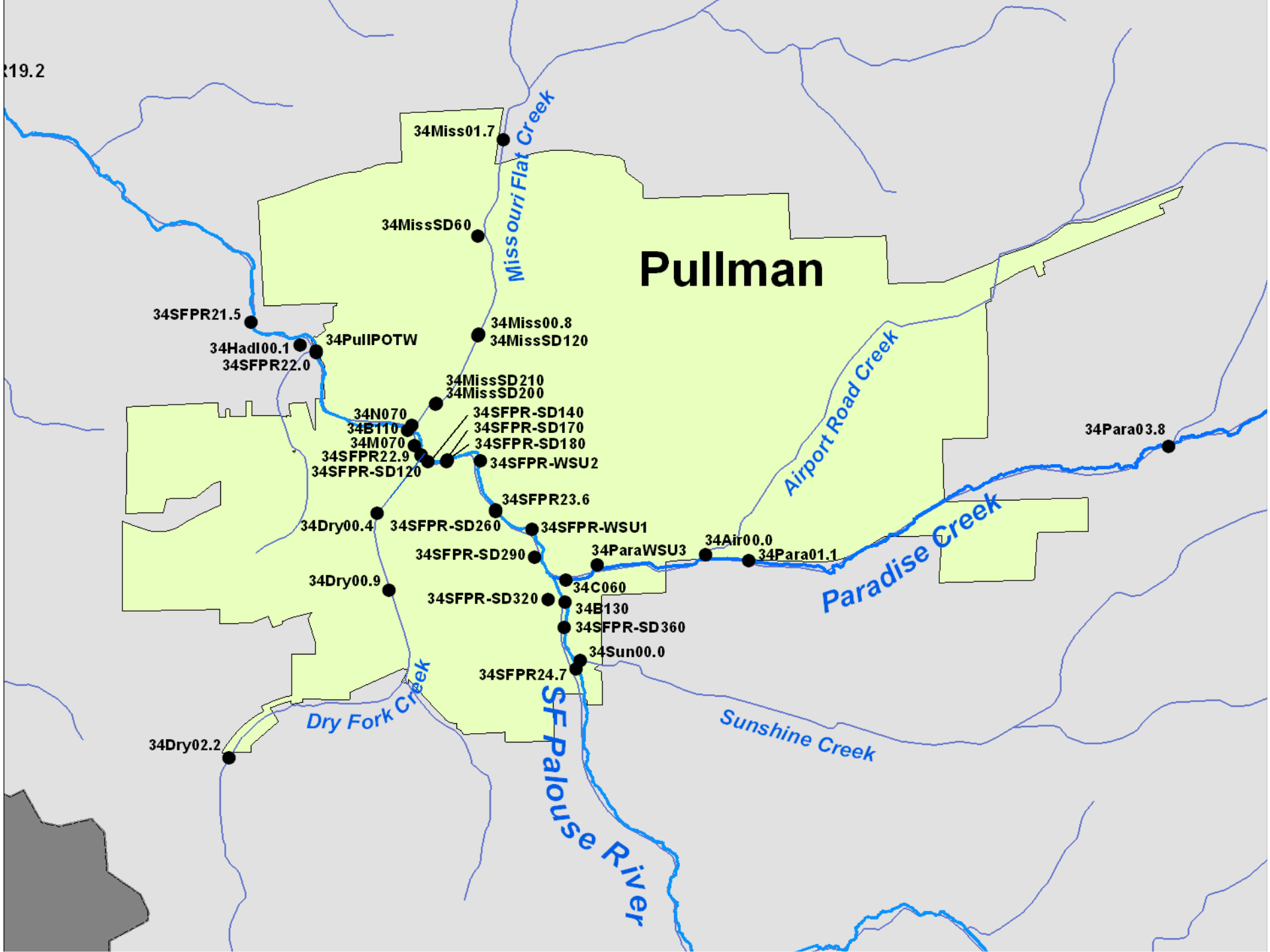
- Identify relative contributions of fecal coliform loading so clean-up activities can focus on the largest sources.

- Establish fecal coliform load allocations (for nonpoint sources) and wasteload allocations (for point sources) to meet water quality standards.

Summary of Data Needs for Fecal Coliform Bacteria TMDL.

- Collect FC bacteria samples from SF Palouse River and tributaries.
- Collect FC bacteria samples from any point sources (pipes).
- Measure flow at all sampling locations


Palouse River
Onaway
Potlatch
Palouse
Colfax
34SFPR00.1
34SFPR01.2
34Spri00.5
34SFPR05.4
Spring Flat Creek
SF Palouse River
34SFPR09.2
34Parv00.1
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Idaho State Line
Albion
34AlbPOTW
34B080
Missouri Flat Creek
34Miss07.5
34UnkSFPR(17.3)
34Miss03.9
34SFPR19.2
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
Sunshine Creek
34Dry02.2
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
Dry Fork Creek
34SFPR31.3
34Stal03.9


R19.2
Pullman
Missouri Flat Creek
34Miss01.7
34MissSD60
34SFPR21.5
34HadI00.1
34SFPR22.0
34PullPOTW
34Miss00.8
34MissSD120
34MissSD210
34MissSD200
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
Airport Road Creek
34Para03.8
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
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34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0
34SFPR24.7
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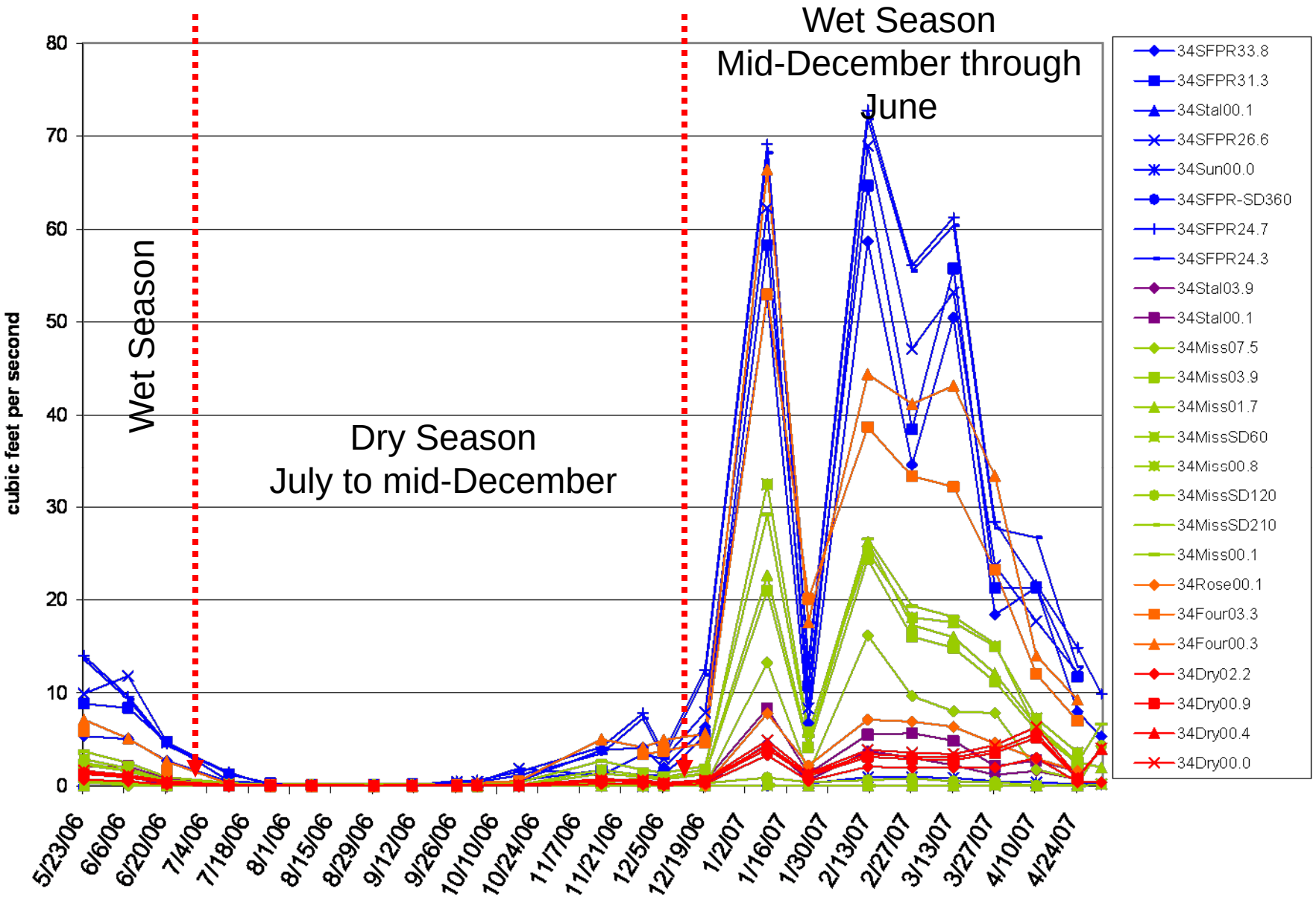

Wet Season
Mid-December through June
Wet Season
Dry Season
July to mid-December
cubic feet per second
80
70
60
50
40
30
20
10
0
5/23/06
6/6/06
6/20/06
7/4/06
7/18/06
8/1/06
8/15/06
8/29/06
9/12/06
9/26/06
10/10/06
10/24/06
11/7/06
11/21/06
12/5/06
12/19/06
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
34SFPR33.8
34SFPR31.3
34Stal00.1
34SFPR26.6
34Sun00.0
34SFPR-SD360
34SFPR24.7
34SFPR24.3
34Stal03.9
34Stal00.1
34Miss07.5
34Miss03.9
34Miss01.7
34MissSD60
34Miss00.8
34MissSD120
34MissSD210
34Miss00.1
34Rose00.1
34Four03.3
34Four00.3
34Dry02.2
34Dry00.9
34Dry00.4
34Dry00.0

Seasonal pollution (potential runoff sources and non-runoff sources)

Runoff (wet season) includes:

- Urban runoff/Stormwater (domestic pet, bird and other animal waste; illegal dumping; failing septic)
- Sanitary sewer failure (over flows, leaking pipes or misconnections)
- Rural runoff (failing septic; farm animal waste; wildlife)
- Forest runoff (wildlife; recreation)

Non-runoff (dry season) includes:

- Point sources (sanitary sewer failure or cross connection to stormdrain)
- Direct deposition by wildlife and other animals
- Illegal dumping or pipes and ditches to surface water
- Non-stormwater (springs or groundwater infiltration; over watering or over-spraying lawn; illegal connection to or dumping to storm sewers)
- Failing septic systems (overland or through ground or straight pipe)

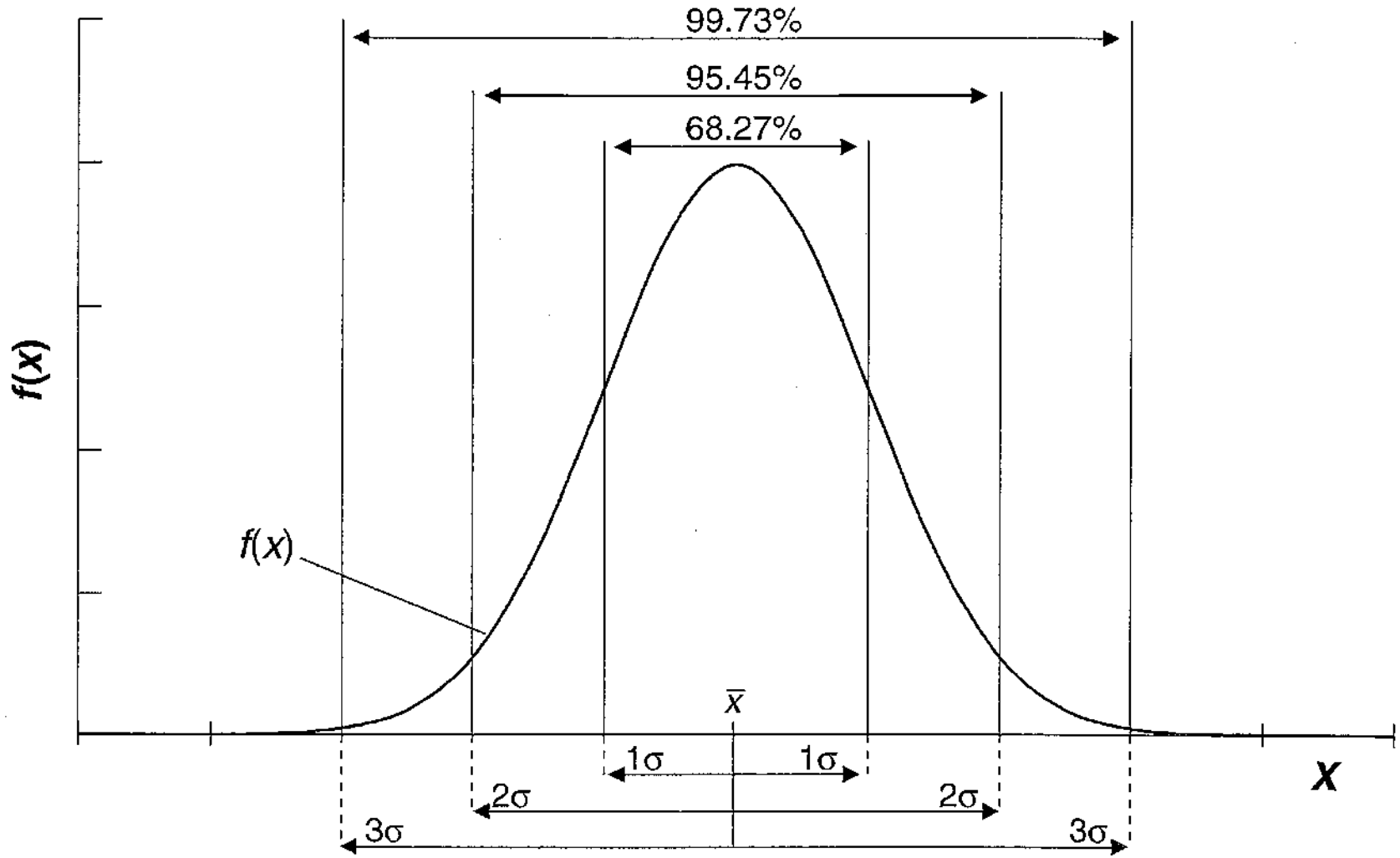
To meet the part of the standard that says:

No more than 10% samples may exceed 200 cfu/100 mL

Make sure the 90th percentile of the data is < 200 cfu/100 mL

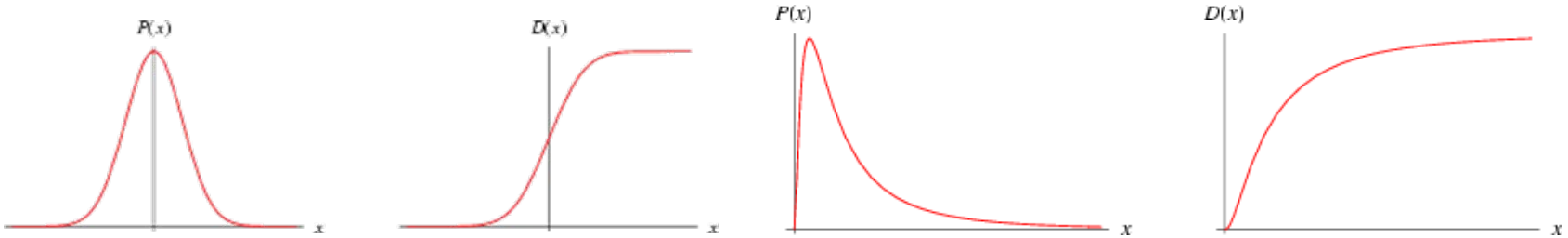
Estimate the 90th percentile of the data using statistical tools:

- define data distribution
- estimate 90th percentile based on distribution.



Adapted from McBean and Rovers, 1998. Statistical Procedures for Analysis of Environmental Data and Risk Assessment. Prentice Hall, Inc. New Jersey

Fecal coliform bacteria concentrations in the environment generally follow a log-normal distribution



Normal distribution Log-normal distribution

X = concentration

P(x) = probability of occurrence of a given concentration = no. of data within range/total data points

D(x) = cumulative probability of a given concentration = ∑P(x)

Establishing <u>Fecal Coliform Bacteria TMDL</u> using *Statistical Rollback Method*

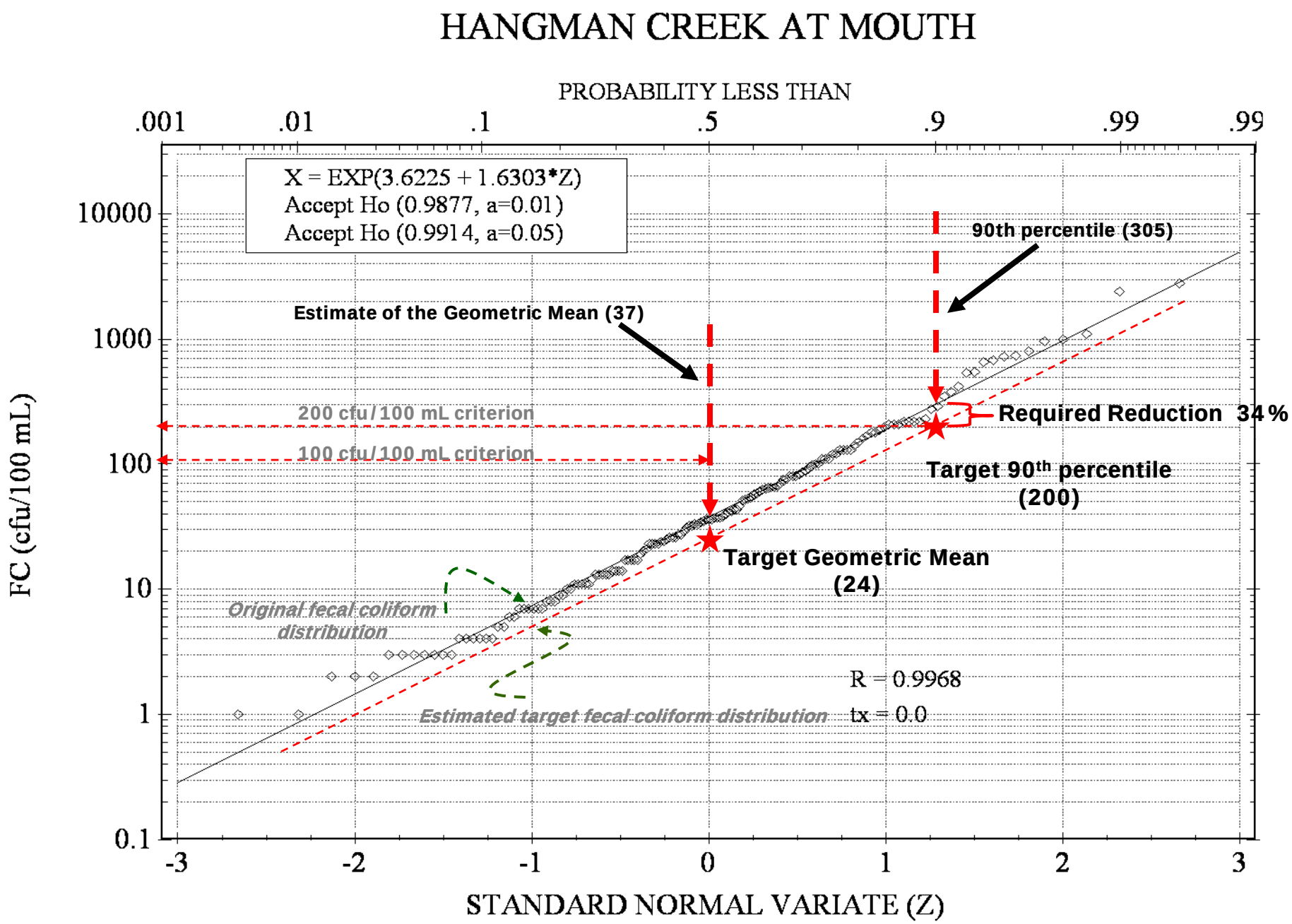
(based upon the theory developed by Ott (1995): *Environmental Statistics and Data Analysis*)

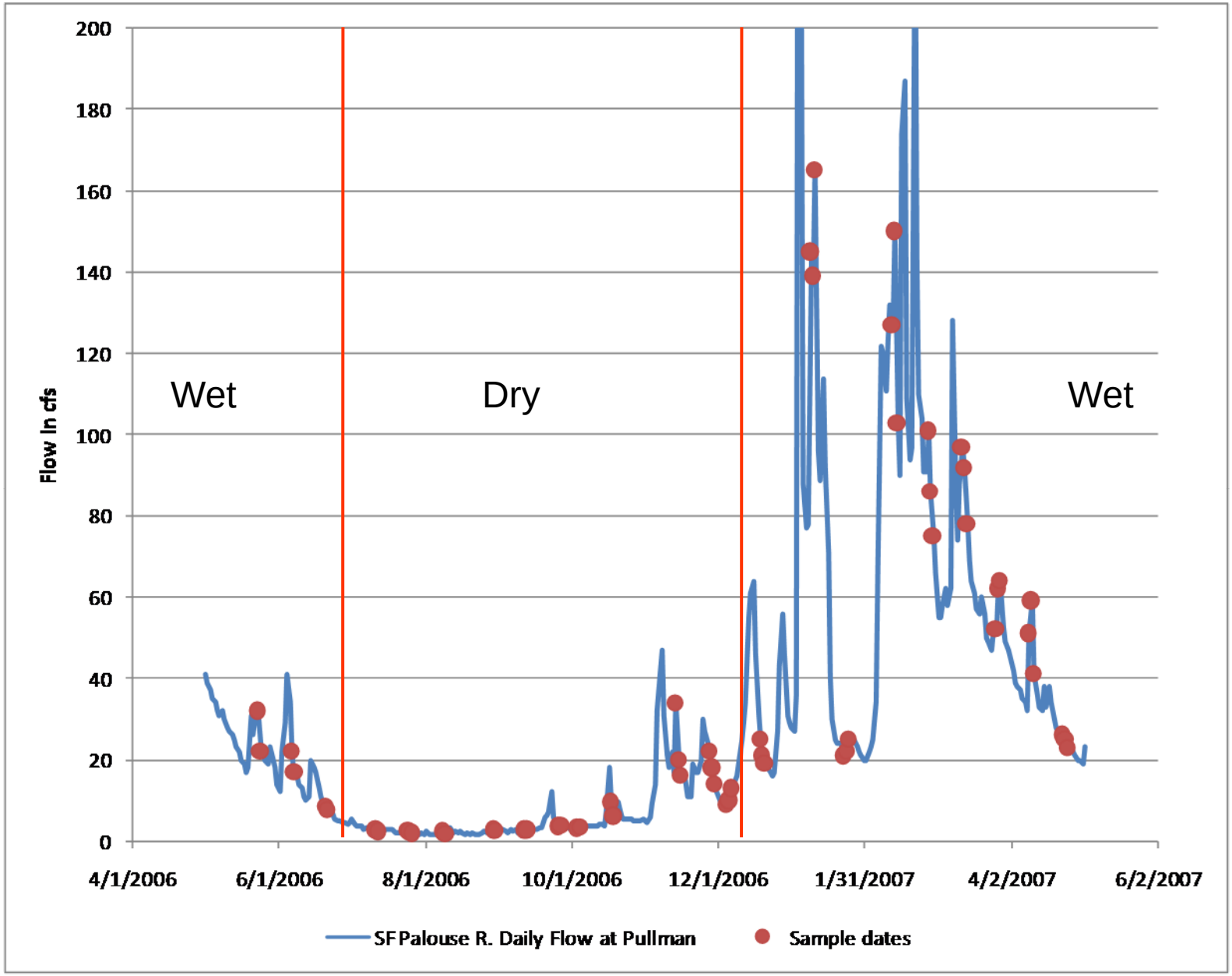
1. Check that bacteria data conforms to log-normal distribution

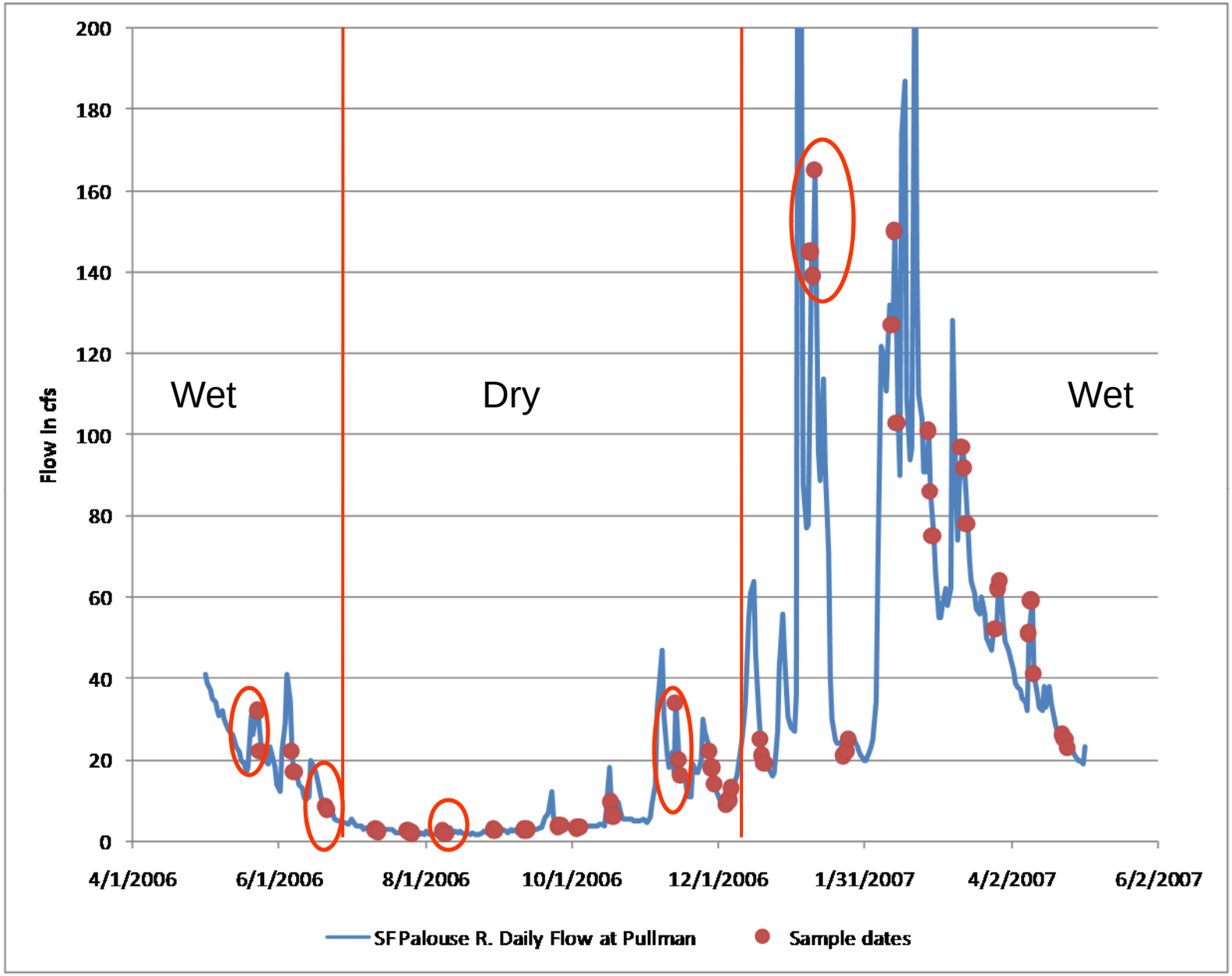
2. 90th percentile conc. = conc. with cumulative probability of 0.9
   = 10^ (mean + 1.281552* standard deviation)

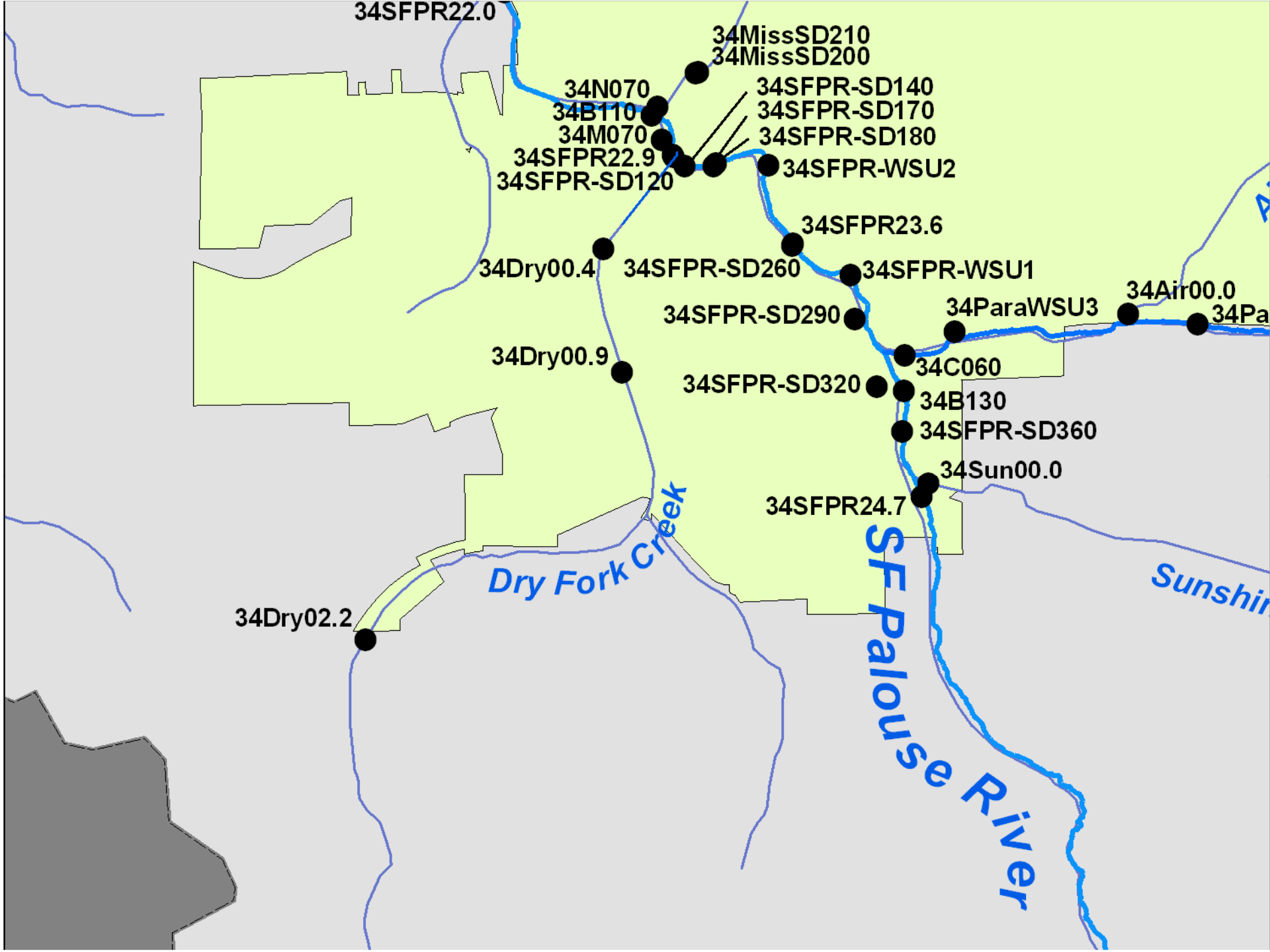
3. Geometric mean = conc. with cumulative probability of 0.5

4. Percent reductions = based on limiting geometric mean or 90th percentile = TMDL


HANGMAN CREEK AT MOUTH
PROBABILITY LESS THAN
.001
.01
.1
.5
.9
.99
.99
X = EXP(3.6225 + 1.6303*Z)
Accept Ho (0.9877, a=0.01)
Accept Ho (0.9914, a=0.05)
90th percentile (305)
Estimate of the Geometric Mean (37)
200 cfu/100 mL criterion
100 cfu/100 mL criterion
Required Reduction 34 %
Target 90th percentile (200)
Target Geometric Mean (24)
Original fecal coliform distribution
Estimated target fecal coliform distribution
R = 0.9968
tx = 0.0
FC (cfu/100 mL)
10000
1000
100
10
1
0.1
-3
-2
-1
0
1
2
3
STANDARD NORMAL VARIATE (Z)

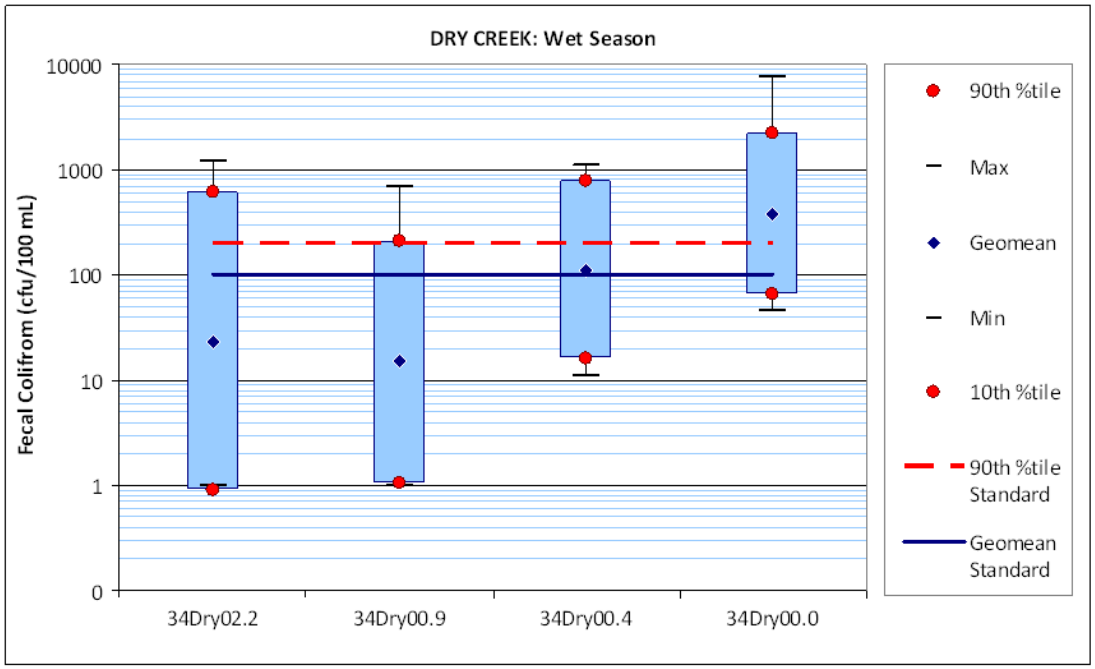

Flow In cfs
200
180
160
140
120
100
80
60
40
20
0
Wet
Dry
Wet
4/1/2006
6/1/2006
8/1/2006
10/1/2006
12/1/2006
1/31/2007
4/2/2007
6/2/2007
SF Palouse R. Daily Flow at Pullman
Sample dates

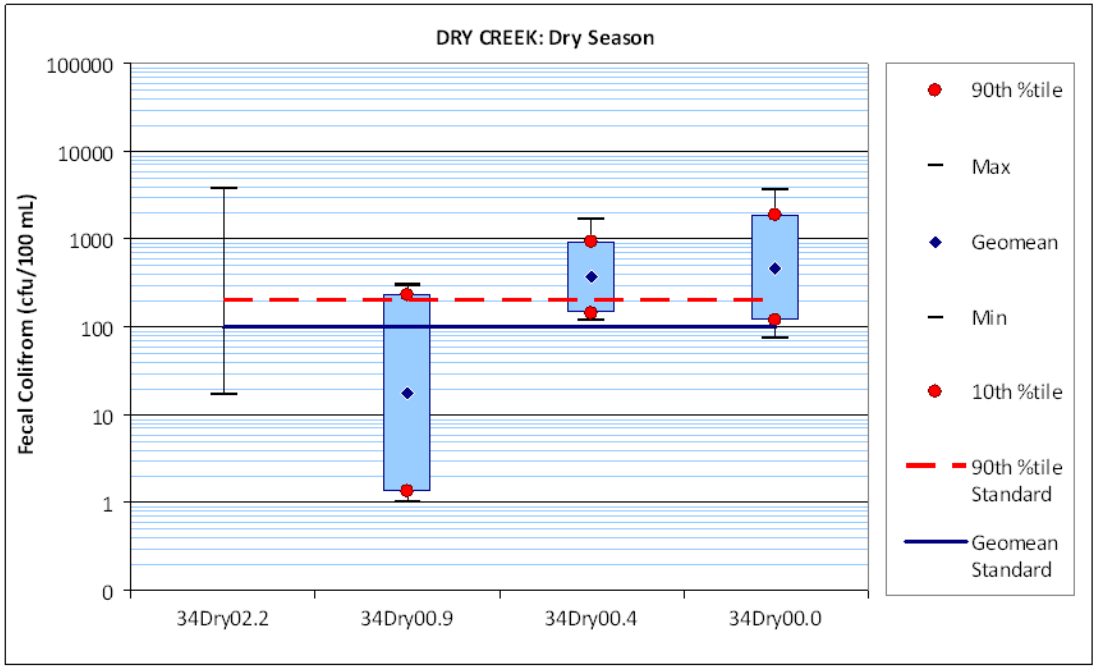

Wet
Dry
Wet
Flow In cfs
200
180
160
140
120
100
80
60
40
20
0
4/1/2006
6/1/2006
8/1/2006
10/1/2006
12/1/2006
1/31/2007
4/2/2007
6/2/2007
SF Palouse R. Daily Flow at Pullman
Sample dates

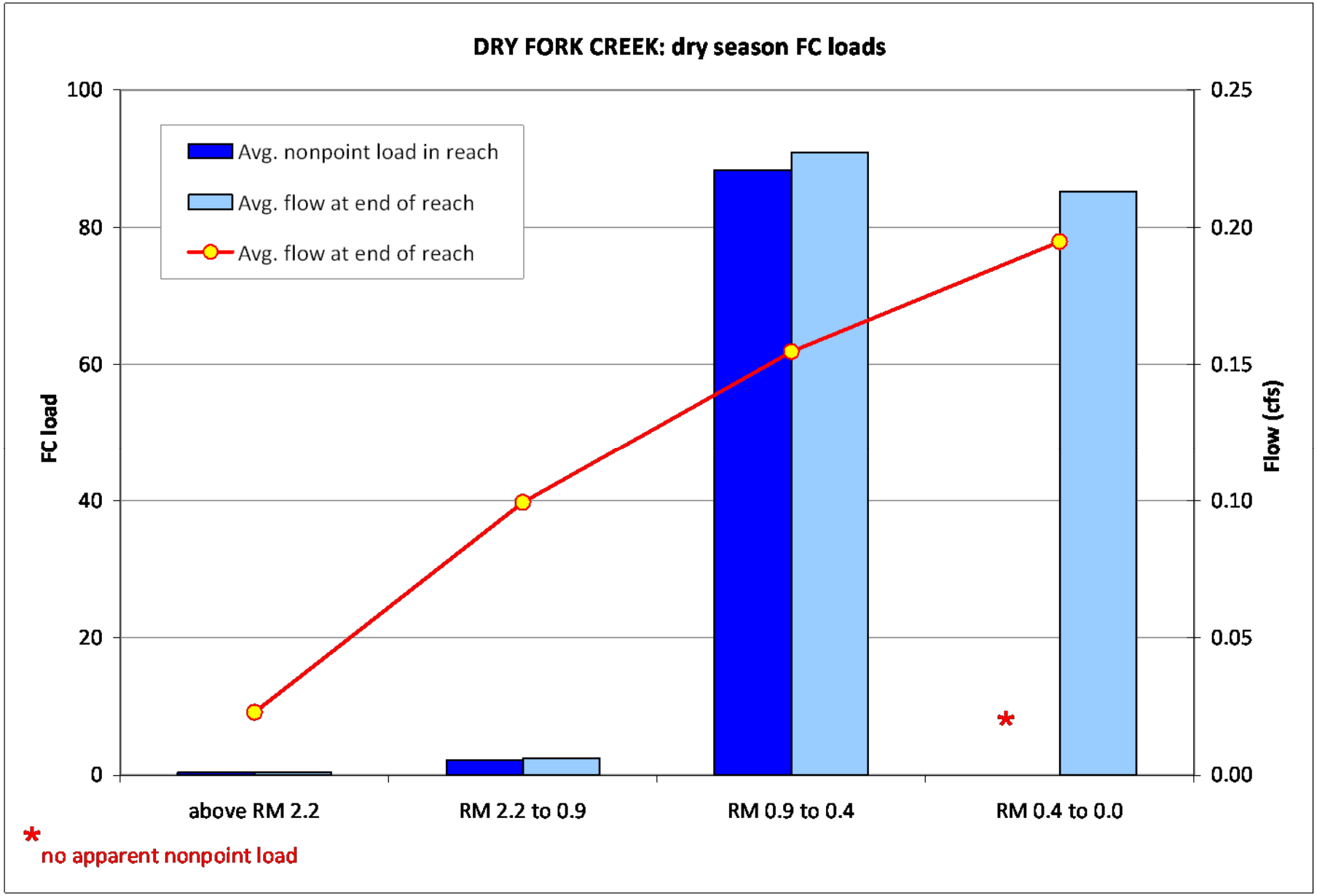

34SFPR22.0
34MissSD210
34MissSD200
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34Air00.0
34ParaWSU3
34SFPR-SD290
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0
34SFPR24.7
Dry Fork Creek
SF Palouse River
34Dry02.2

Dry Creek								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34Dry02.2	9	1	0.9	23	614	1200	22%	**67%**
34Dry00.9	12	1	1.1	15	214	700	17%	**7%**
34Dry00.4	12	11	15.9	112	788	1100	50%	**75%**
34Dry00.0	12	46	66	380	2199	7500	83%	**91%**
	DRY SEASON							
34Dry02.2	2	17	----	----	----	3800	----	**99%**
34Dry00.9	11	1	1.3	18	234	300	9%	**14%**
34Dry00.4	11	120	145	370	943	1700	82%	**79%**
34Dry00.0	11	75	118	474	1901	3600	82%	**89%**

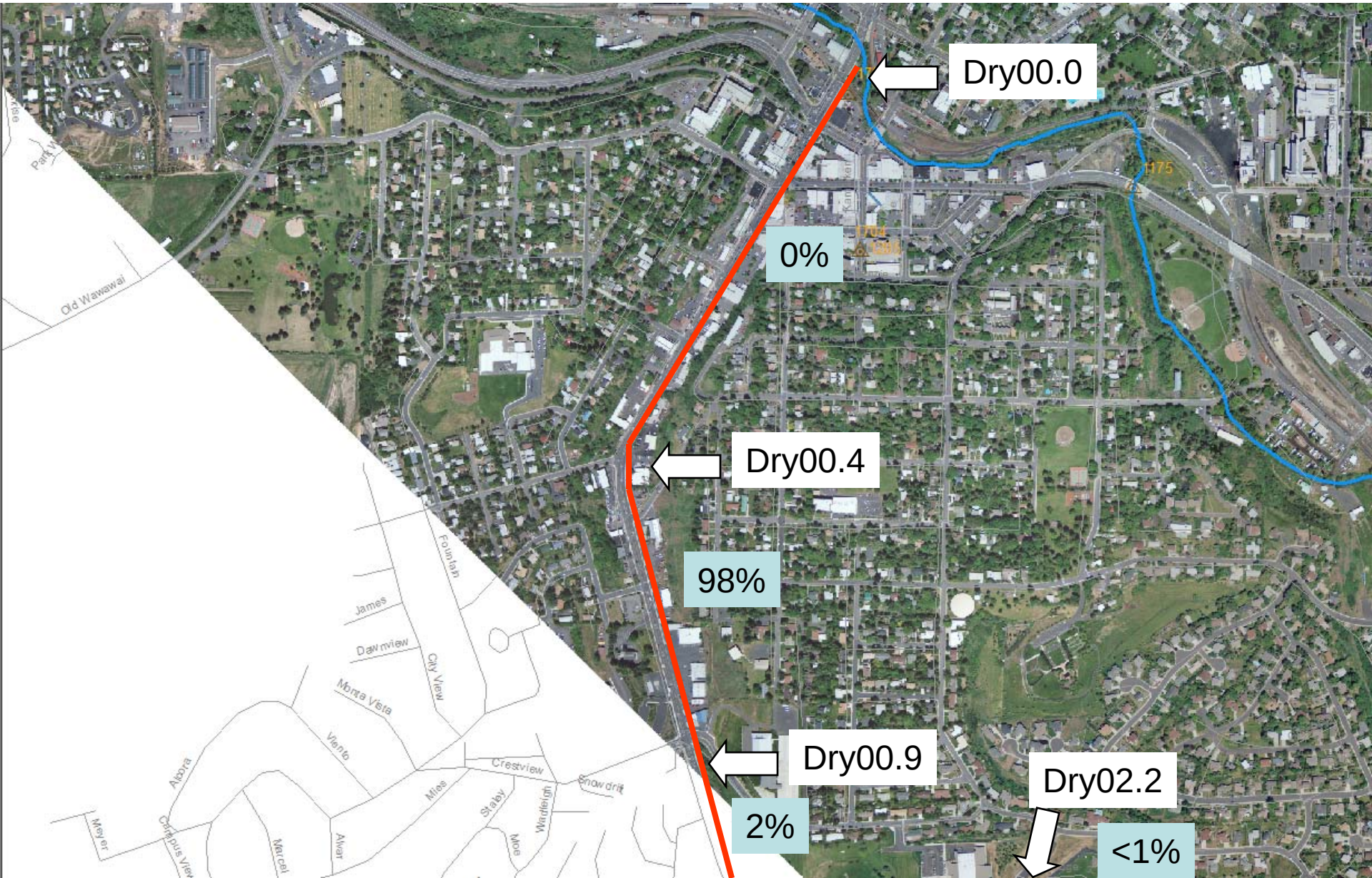
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season


DRY CREEK: Wet Season
Fecal Colifrom (cfu/100 mL)
10000
1000
100
10
1
0
34Dry02.2
34Dry00.9
34Dry00.4
34Dry00.0
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard

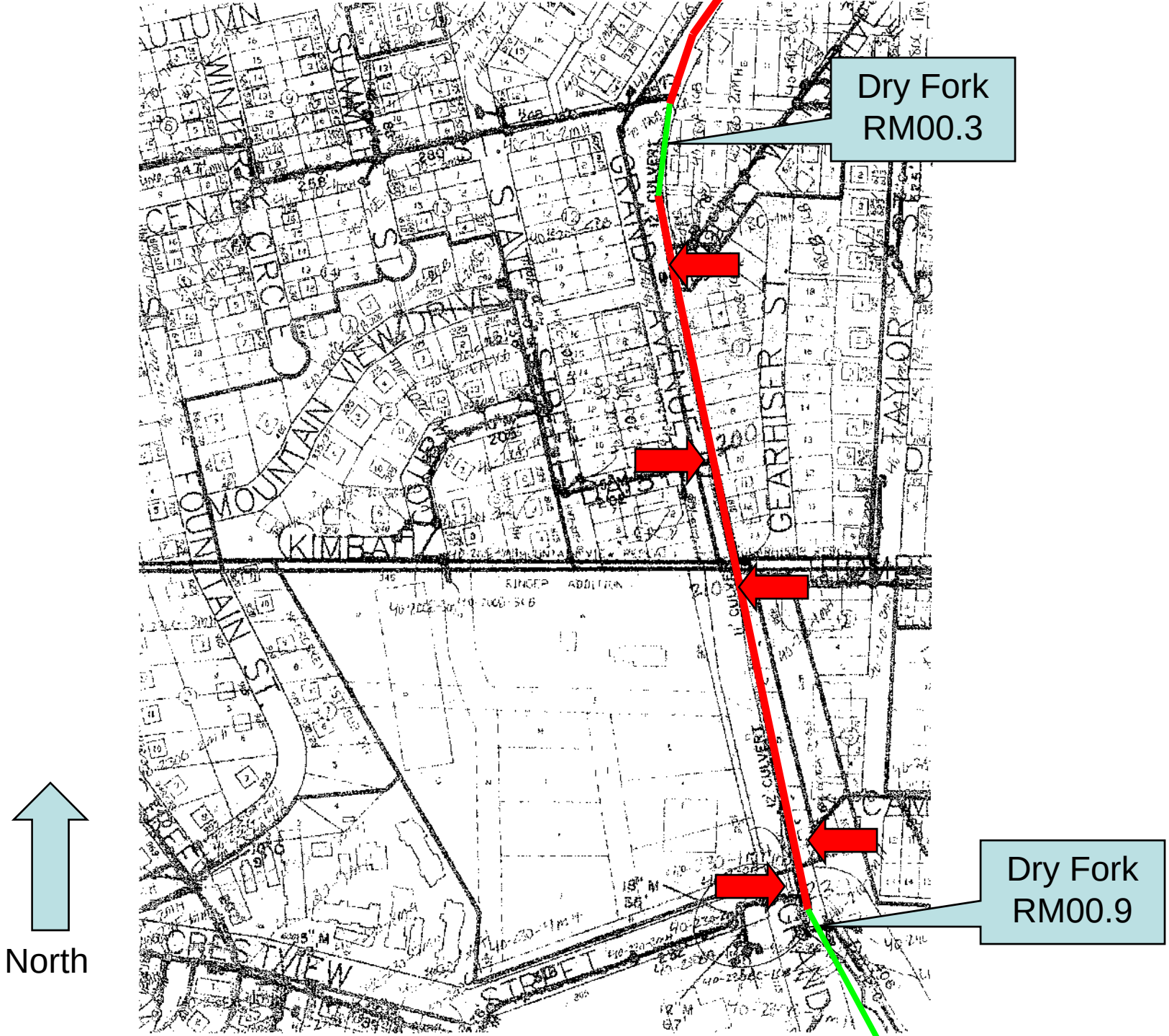

DRY CREEK: Dry Season
Fecal Colifrom (cfu/100 mL)
100000
10000
1000
100
10
1
0
34Dry02.2
34Dry00.9
34Dry00.4
34Dry00.0
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard

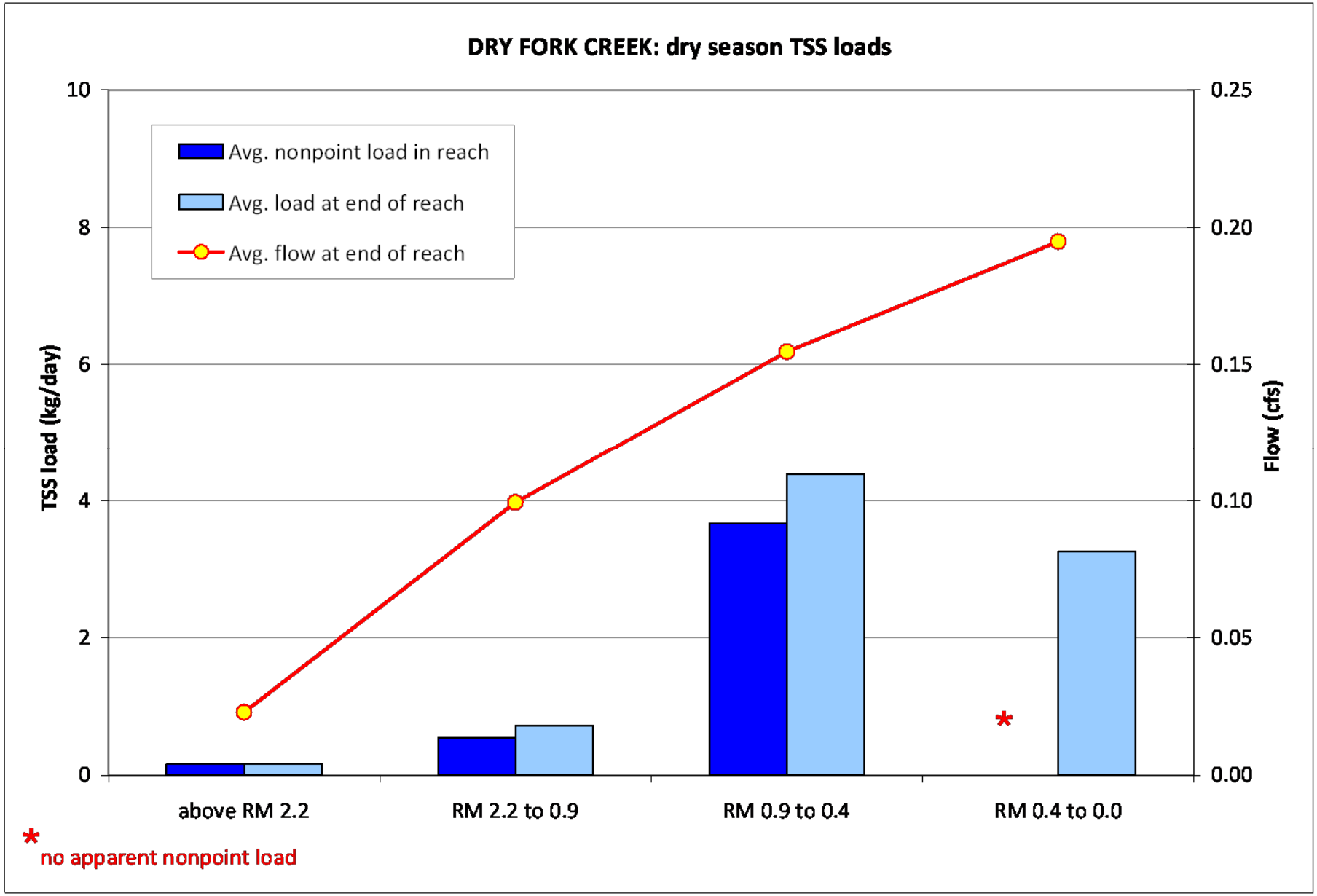

DRY FORK CREEK: dry season FC loads
Avg. nonpoint load in reach
Avg. flow at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
100
80
60
40
20
0
0.25
0.20
0.15
0.10
0.05
0.00
*
above RM 2.2
RM 2.2 to 0.9
RM 0.9 to 0.4
RM 0.4 to 0.0
* no apparent nonpoint load

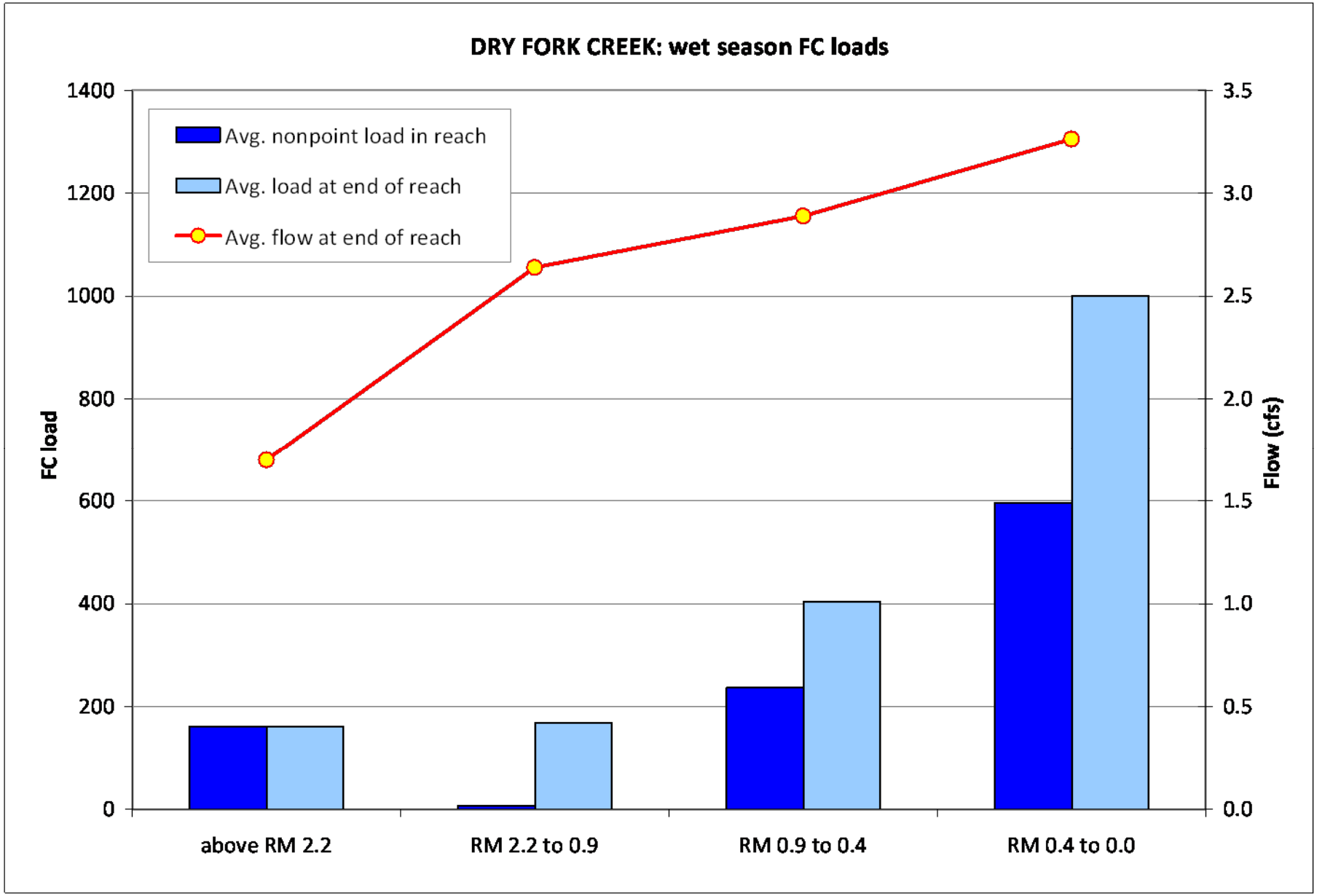
Map of Pullman – Dry Fork Creek (dry season)



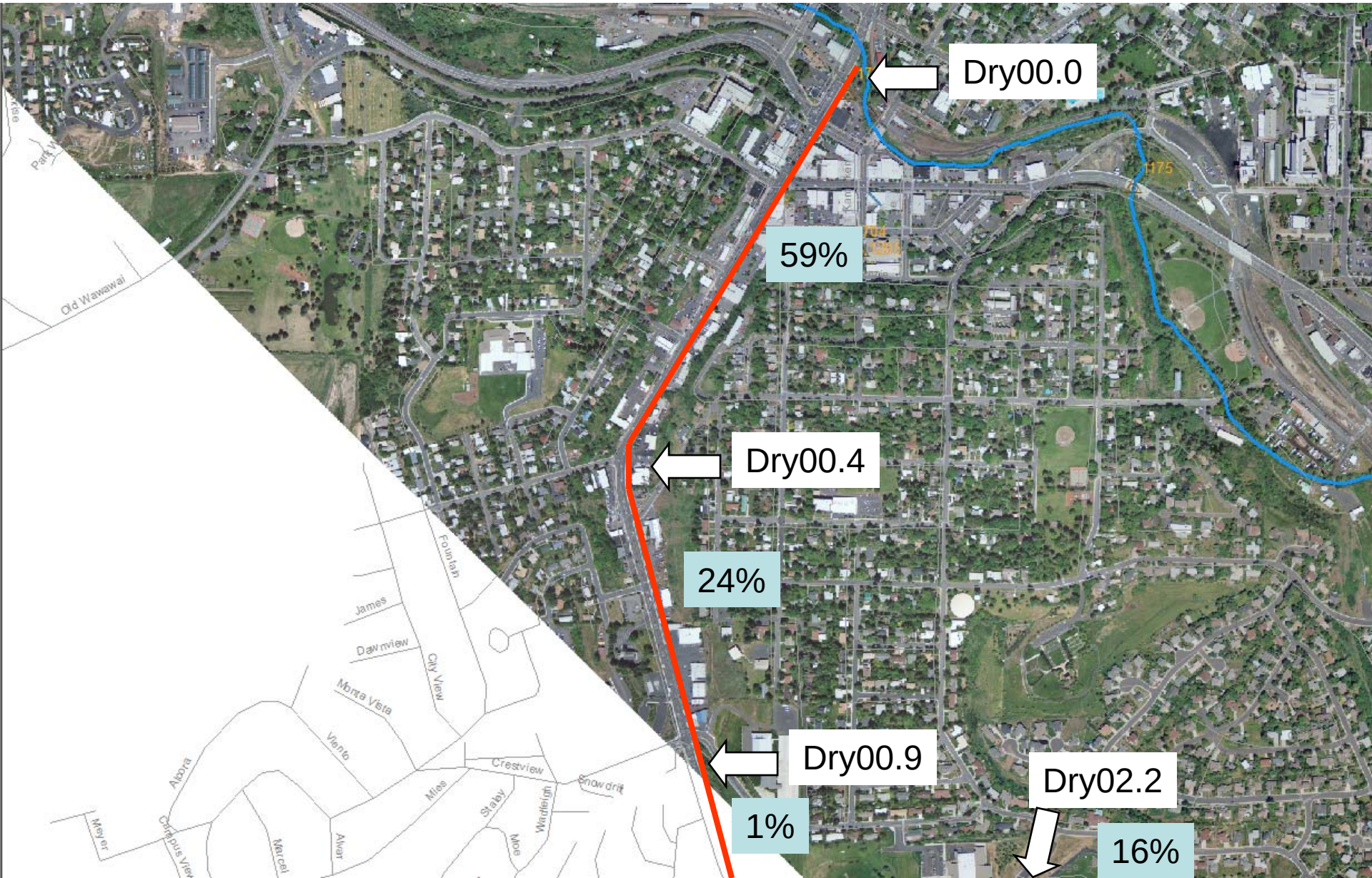
TEXACO
SELF
U-HAUL


Dry Fork
RM00.3
Dry Fork
RM00.9
North
MOUNTAIN VIEW DRIVE
KIMBAL
GEARHISER ST
CRESTVIEW
STREET
12" CULVERT

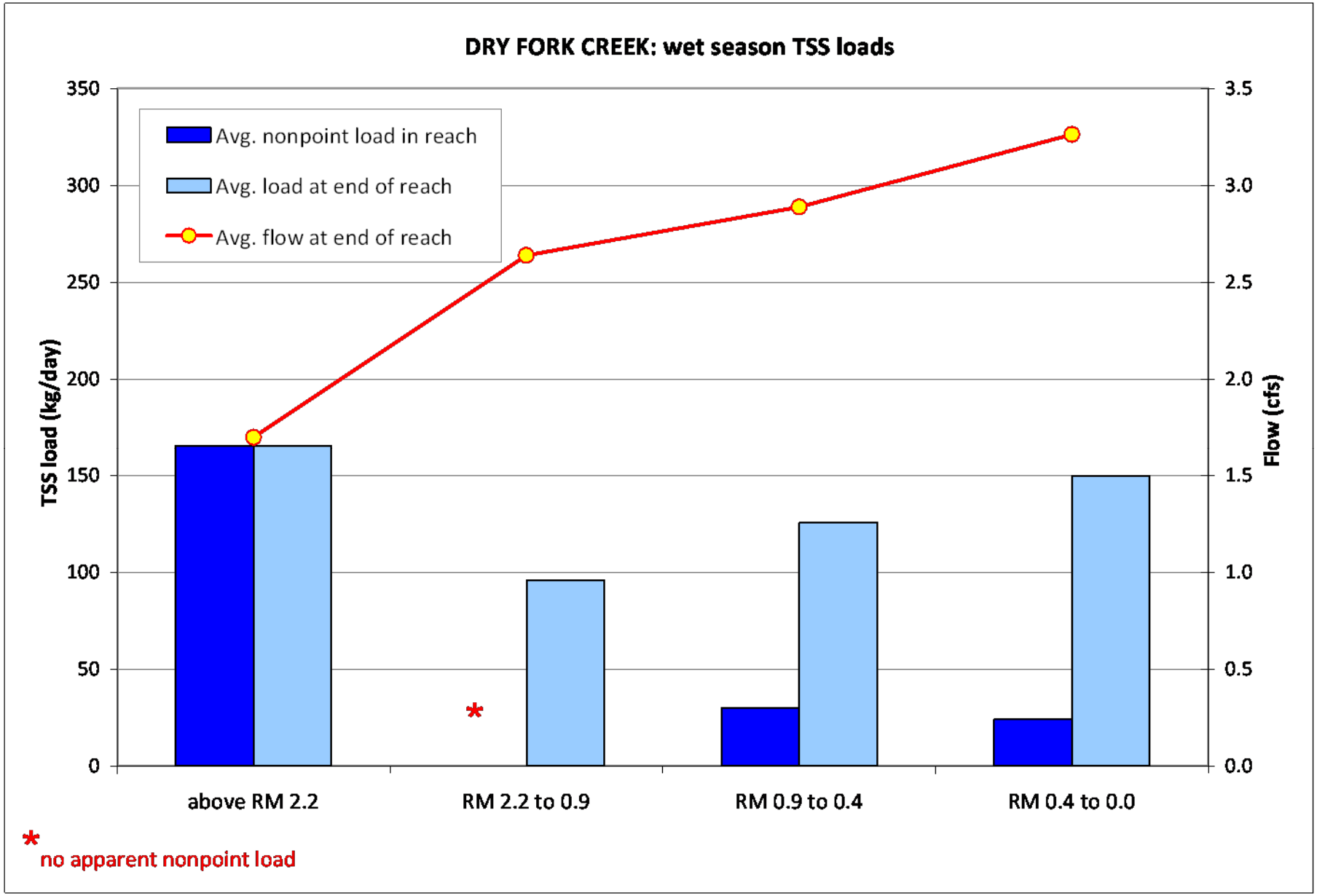

DRY FORK CREEK: dry season TSS loads
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
10
8
6
4
2
0
0.25
0.20
0.15
0.10
0.05
0.00
*
above RM 2.2
RM 2.2 to 0.9
RM 0.9 to 0.4
RM 0.4 to 0.0
* no apparent nonpoint load

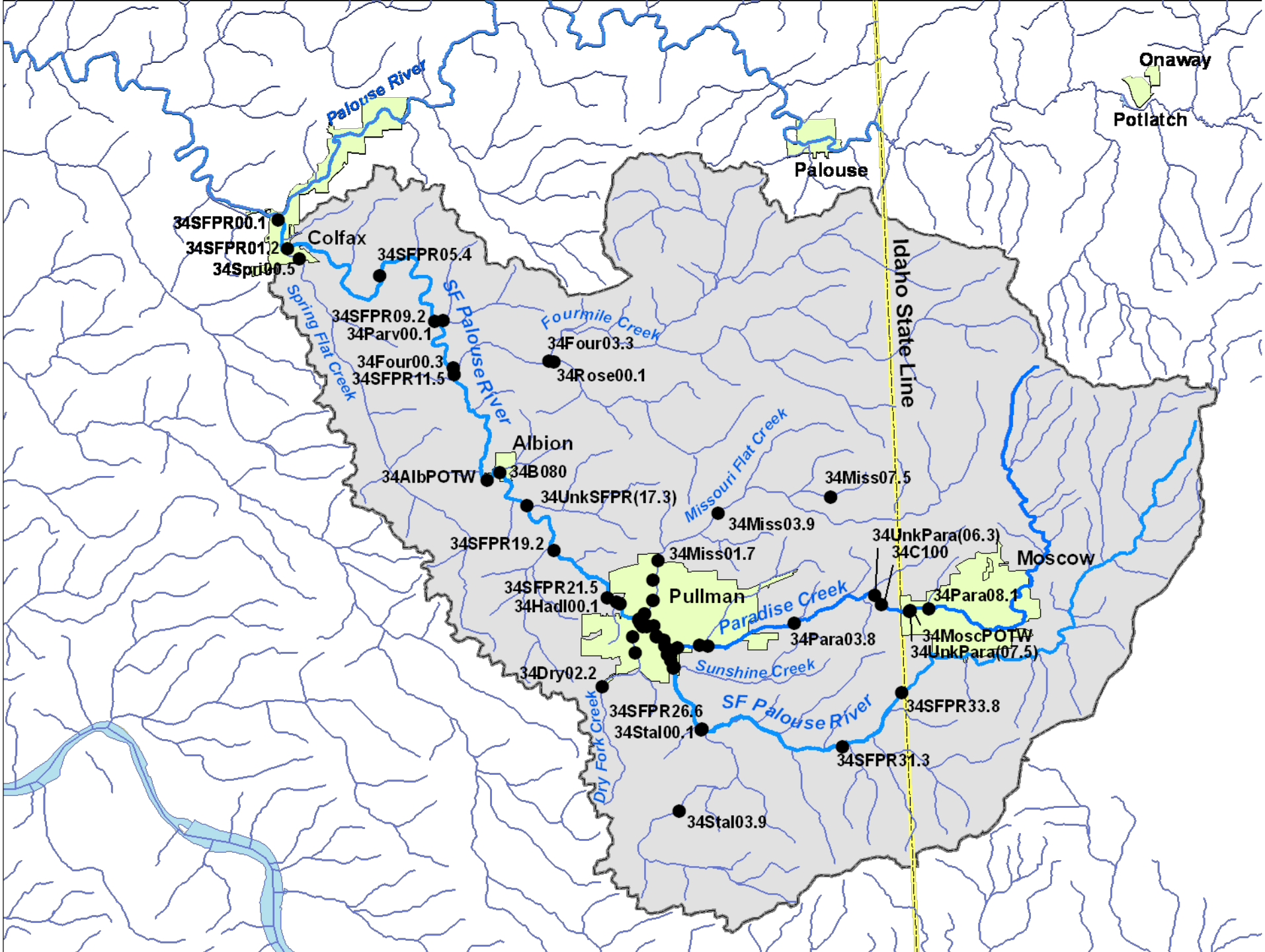

DRY FORK CREEK: wet season FC loads
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
1400
1200
1000
800
600
400
200
0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
above RM 2.2
RM 2.2 to 0.9
RM 0.9 to 0.4
RM 0.4 to 0.0

Map of Pullman – Dry Fork Creek (wet season)



Audio


DRY FORK CREEK: wet season TSS loads
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
350
300
250
200
150
100
50
0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
*
above RM 2.2
RM 2.2 to 0.9
RM 0.9 to 0.4
RM 0.4 to 0.0
* no apparent nonpoint load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Spring Flat Creek
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34SFPR09.2
34Parv00.1
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34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Idaho State Line
Albion
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34B080
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34Miss07.5
34UnkSFPR(17.3)
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34SFPR19.2
34Miss01.7
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Moscow
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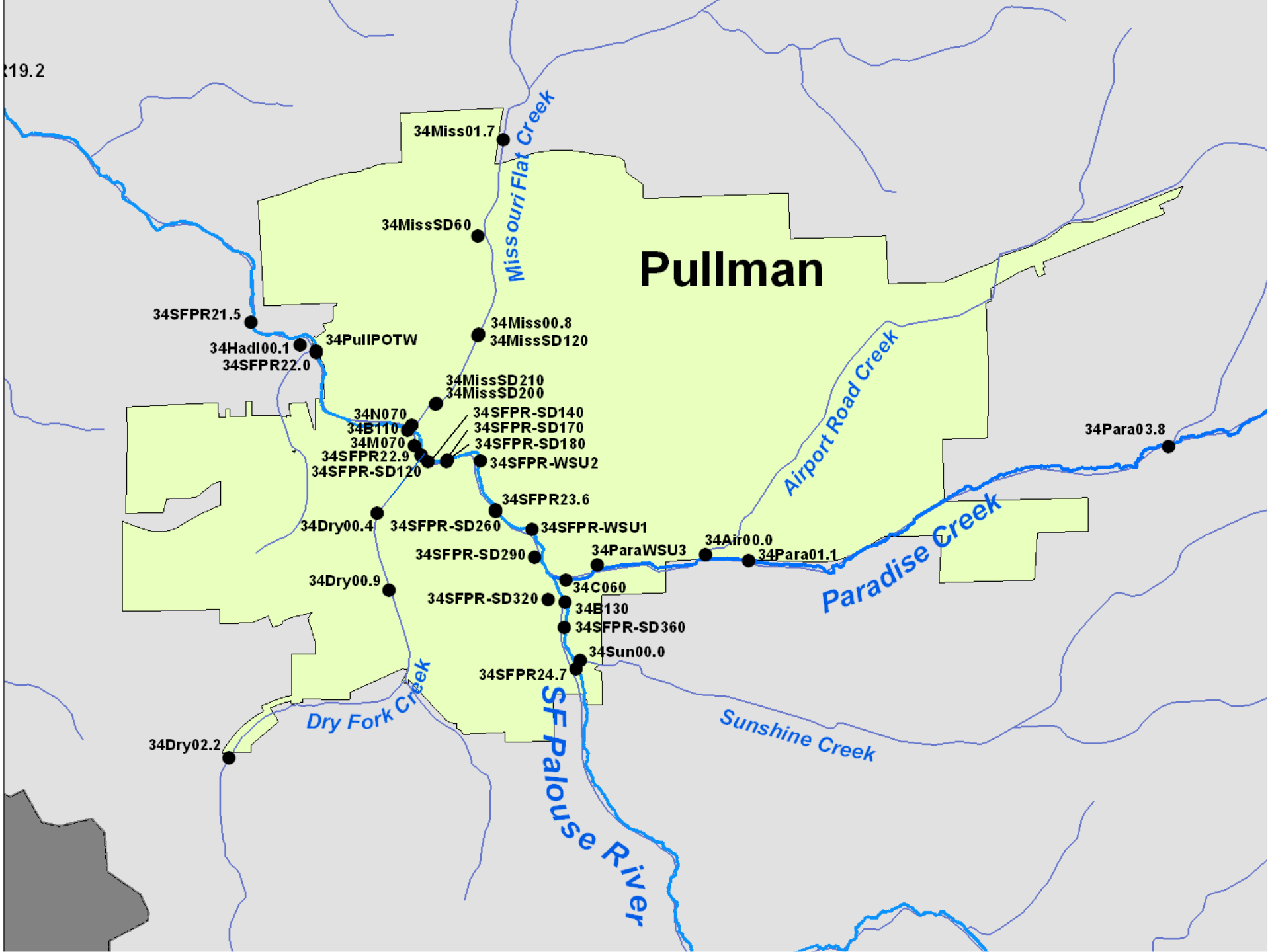
34SFPR26.6
34Stal00.1
Dry Fork Creek
34SFPR31.3
34Stal03.9


R19.2
Pullman
Missouri Flat Creek
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34HadI00.1
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34PullPOTW
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34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
Airport Road Creek
34Para03.8
34SFPR23.6
34Dry00.4
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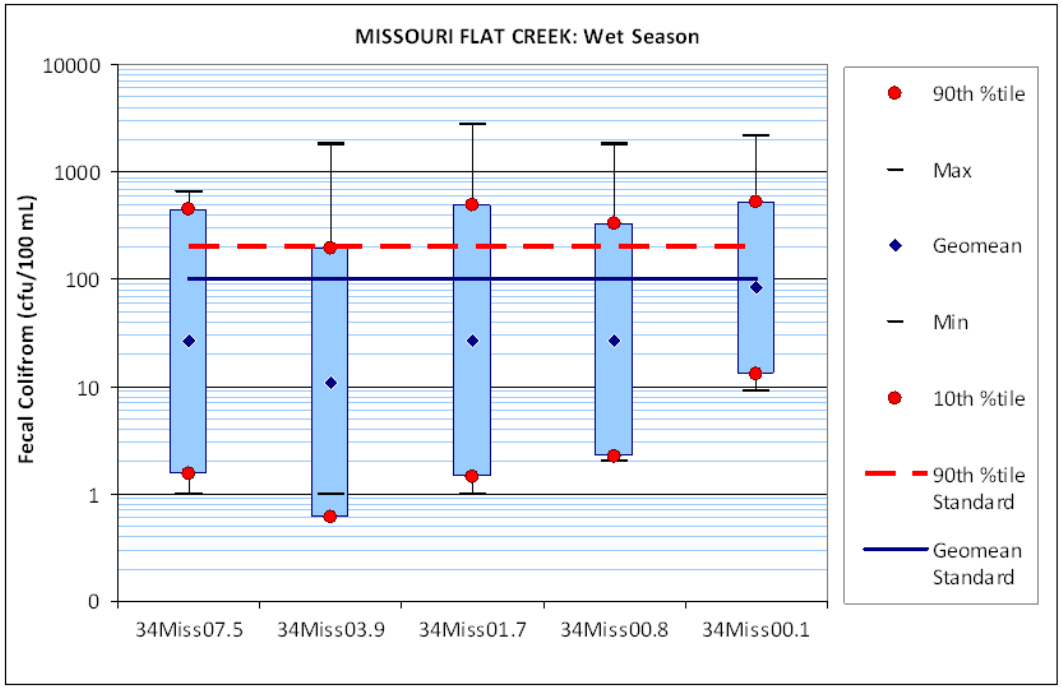
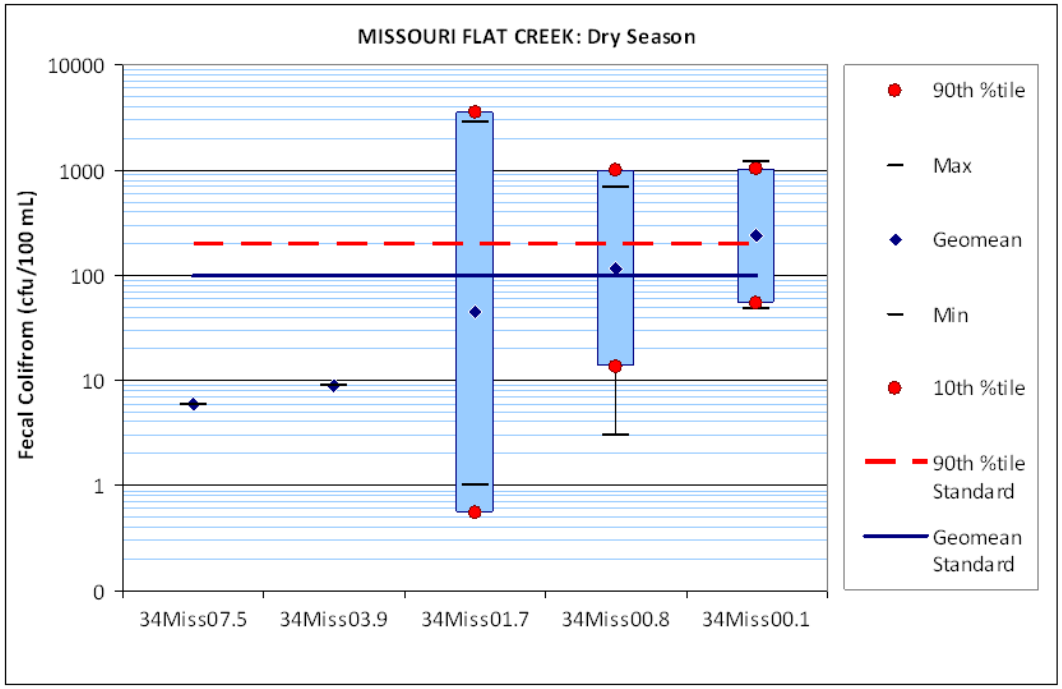
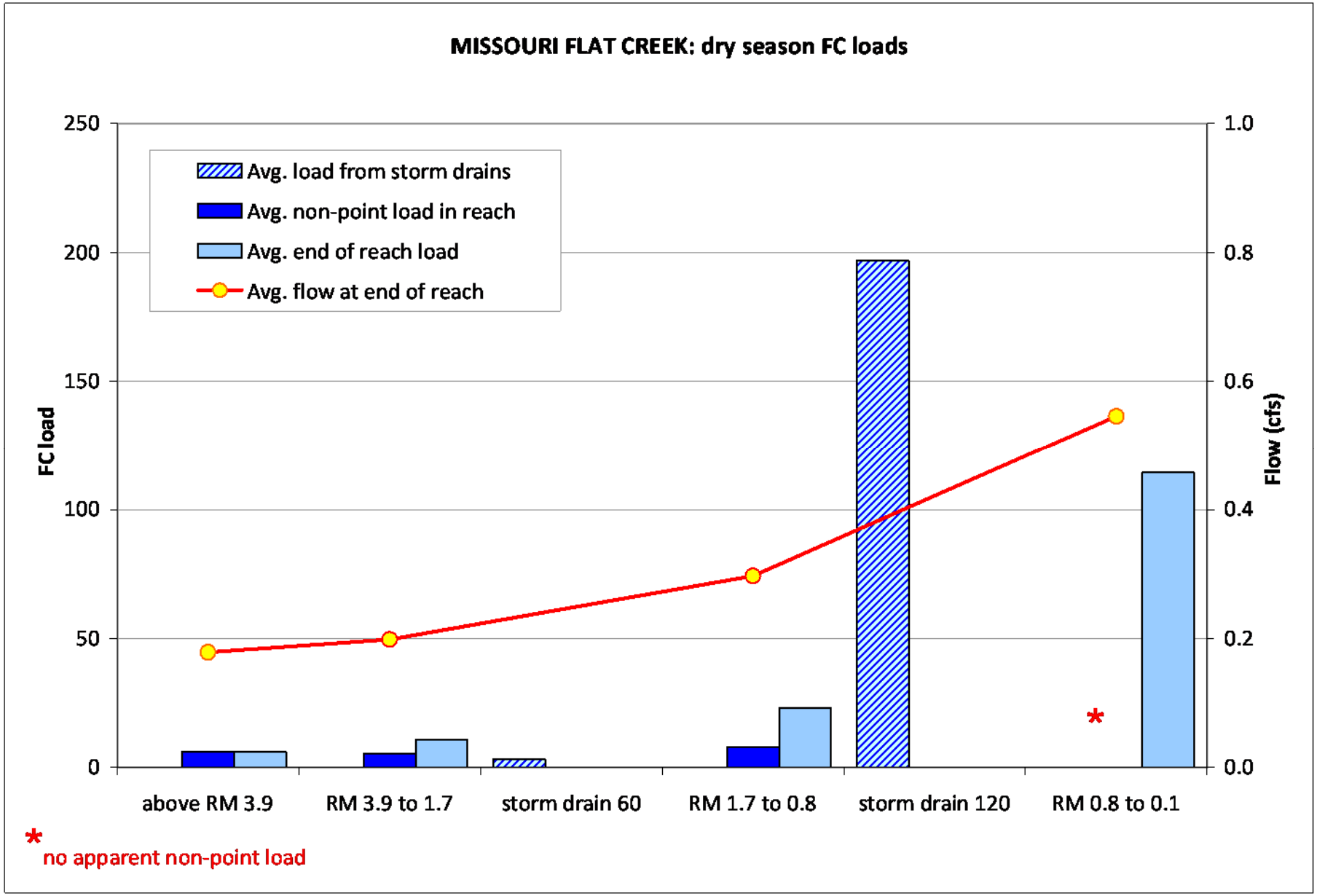
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
Paradise Creek
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0
34SFPR24.7
Dry Fork Creek
SF Palouse River
Sunshine Creek
34Dry02.2

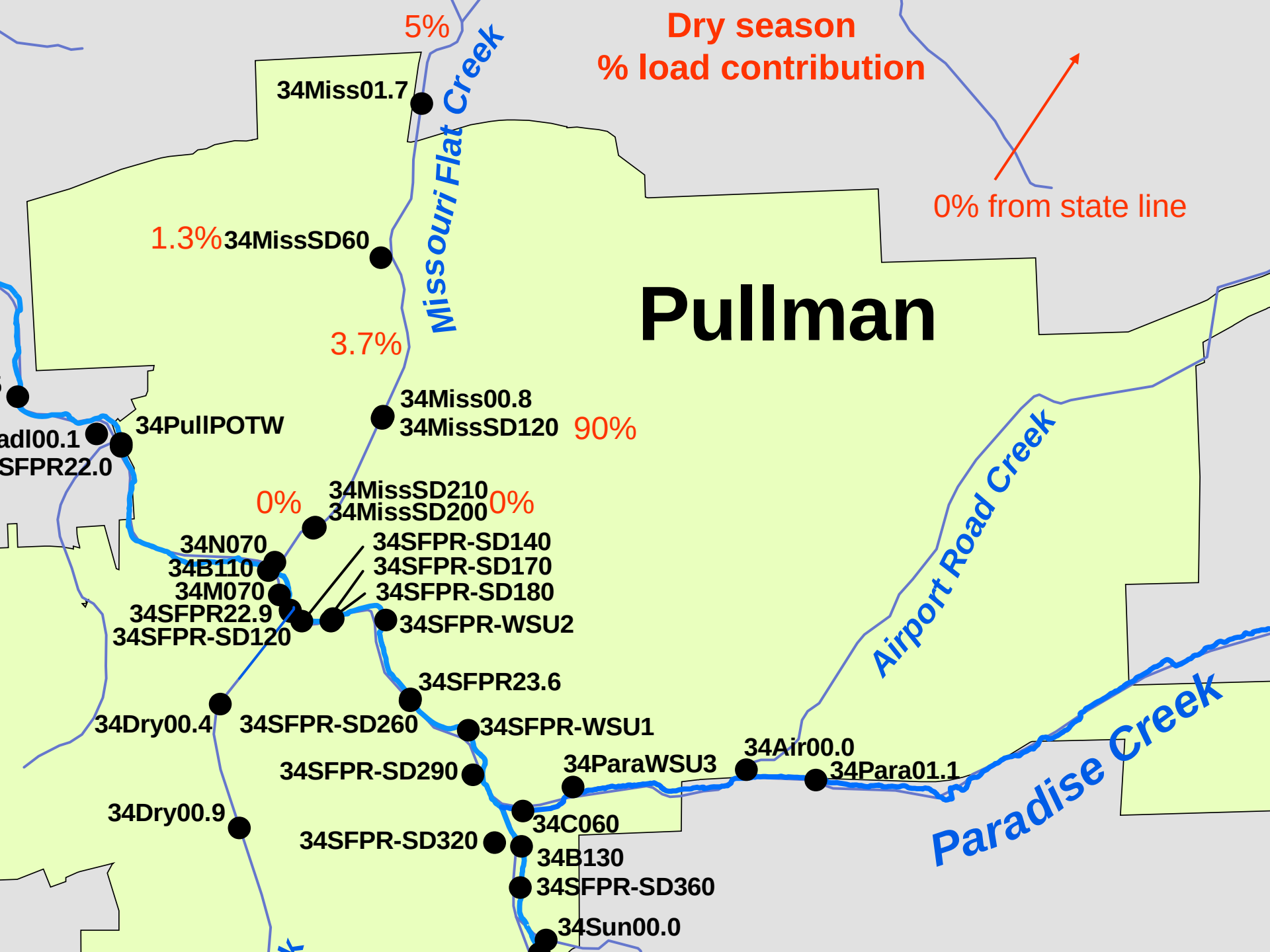
Missouri Flat Creek								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34Miss07.5	8	1	1.5	26	455	650	25%	**56%**
34Miss03.9	11	1	0.6	11	194	1800	9%	**0%**
34Miss01.7	12	1	1.4	27	499	2800	17%	**60%**
34MissSD60	11	1	1.2	14	160	215	9%	**0%**
34Miss00.8	12	2	2.2	27	325	1800	17%	**38%**
34MissSD120	11	29	111	536	2594	2800	91%	**92%**
34MissSD200	1	410	----	----	----	410	----	**76%**
34MissSD210	6	69	65	275	1152	1700	67%	**83%**
34Miss00.1	12	9	13.3	84	530	2200	25%	**62%**
	DRY SEASON							
34Miss07.5	1	6	----	6	----	6	0%	**0%**
34Miss03.9	1	9	----	9	----	9	0%	**0%**
34Miss01.7	7	1	0.6	45	3557	2800	43%	**94%**
34MissSD60	6	27	37	373	3810	4000	67%	**95%**
34Miss00.8	9	3	14	116	987	690	33%	**80%**
34MissSD120	11	130	229	769	2587	3450	91%	**92%**
34MissSD200	0	----	----	----	----	----	----	**---**
34MissSD210	1	2000	----	----	----	2000	----	**95%**
34Miss00.1	11	48	54	237	1034	1200	55%	**81%**

*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

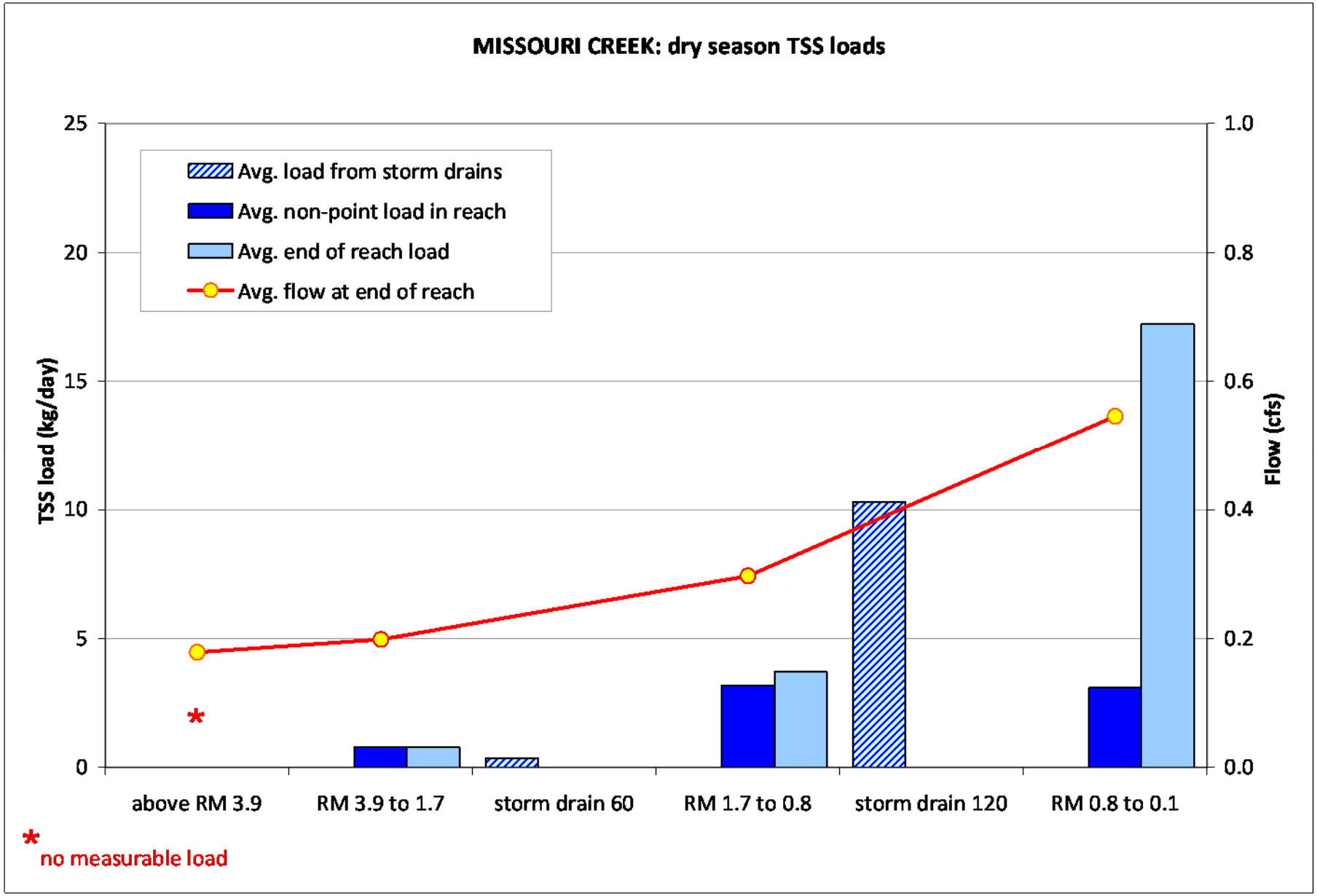

MISSOURI FLAT CREEK: Wet Season
Fecal Colifrom (cfu/100 mL)
10000
1000
100
10
1
0
34Miss07.5
34Miss03.9
34Miss01.7
34Miss00.8
34Miss00.1
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard

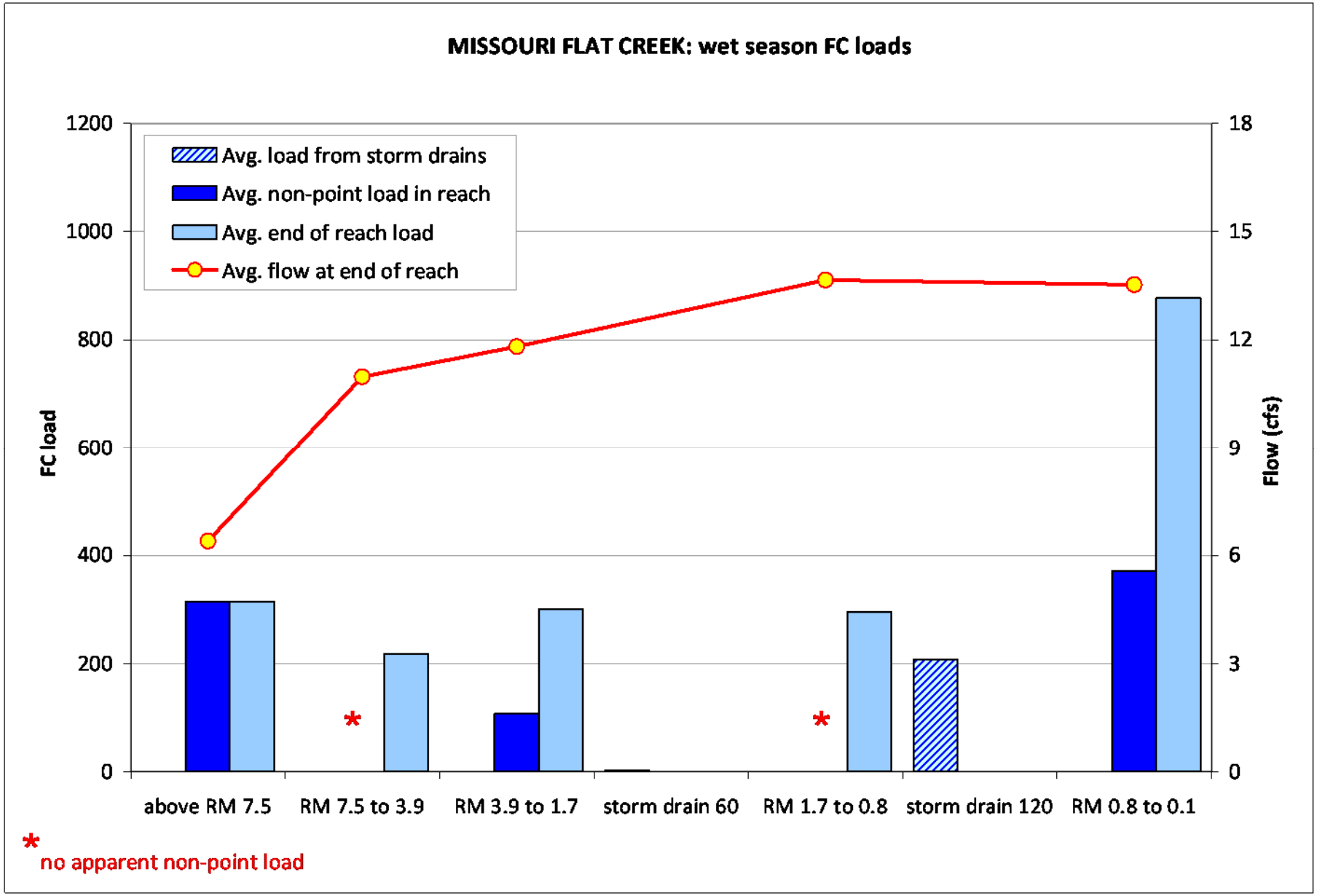

MISSOURI FLAT CREEK: Dry Season
Fecal Colifrom (cfu/100 mL)
10000
1000
100
10
1
0
34Miss07.5
34Miss03.9
34Miss01.7
34Miss00.8
34Miss00.1
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard

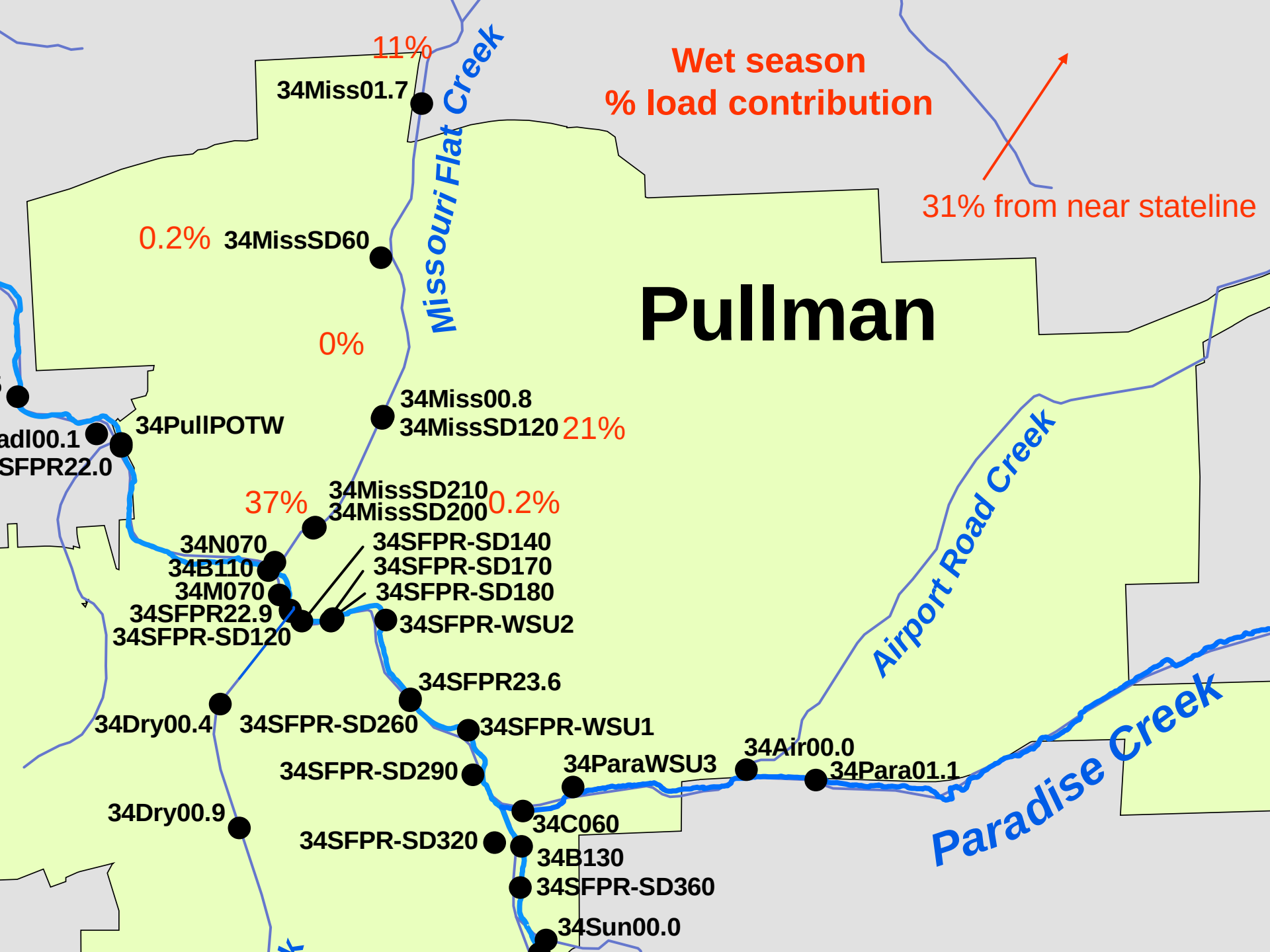

MISSOURI FLAT CREEK: dry season FC loads
Avg. load from storm drains
Avg. non-point load in reach
Avg. end of reach load
Avg. flow at end of reach
FC load
Flow (cfs)
250
200
150
100
50
0
1.0
0.8
0.6
0.4
0.2
0.0
*
above RM 3.9
RM 3.9 to 1.7
storm drain 60
RM 1.7 to 0.8
storm drain 120
RM 0.8 to 0.1
* no apparent non-point load

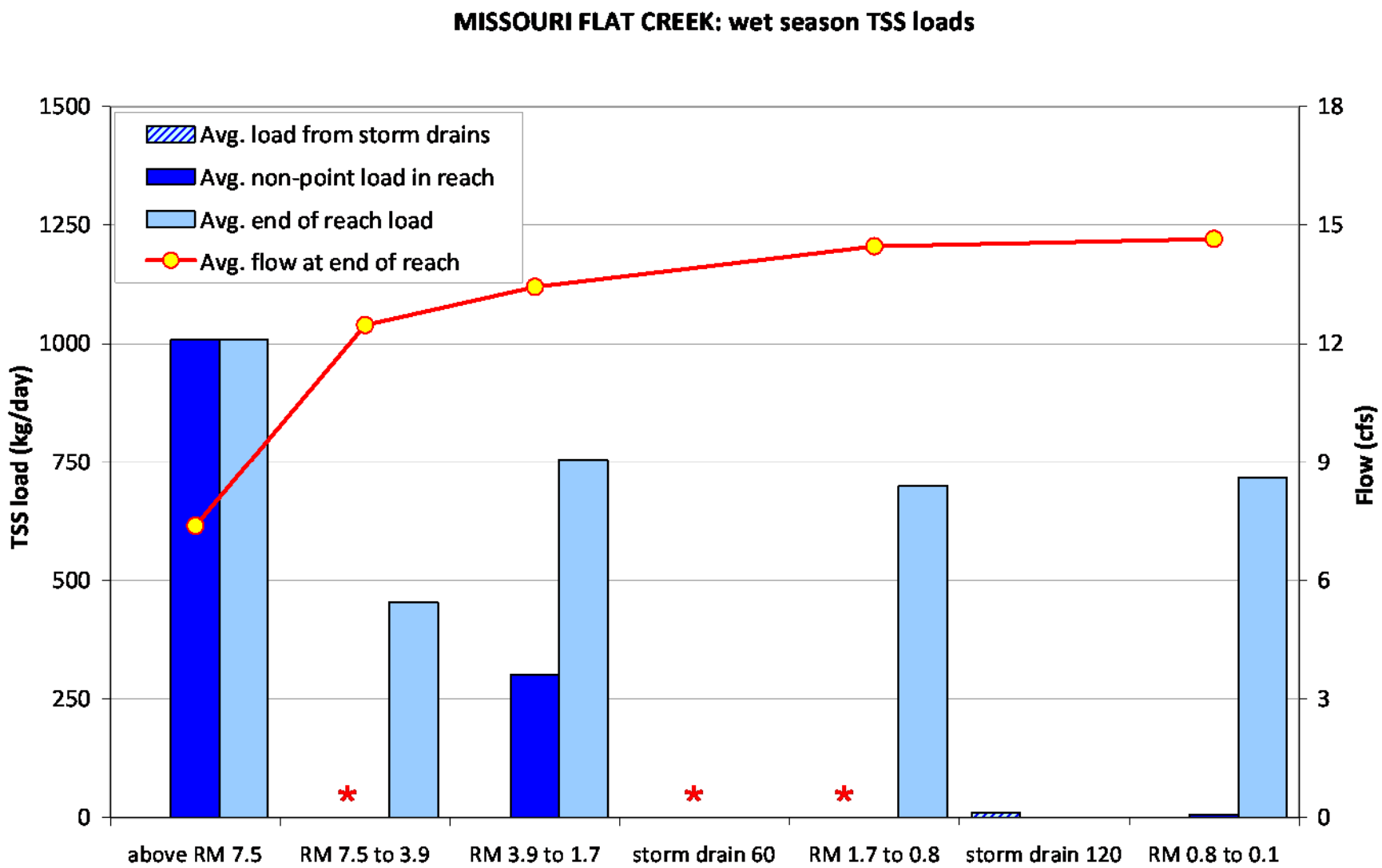

Dry season
% load contribution
0% from state line
Pullman
Missouri Flat Creek
Airport Road Creek
Paradise Creek
5%
34Miss01.7
1.3%
34MissSD60
3.7%
34Miss00.8
34MissSD120
90%
34PullPOTW
adl00.1
SFPR22.0
0%
34MissSD210
34MissSD200
0%
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0

IN THE
BOX
Everything.

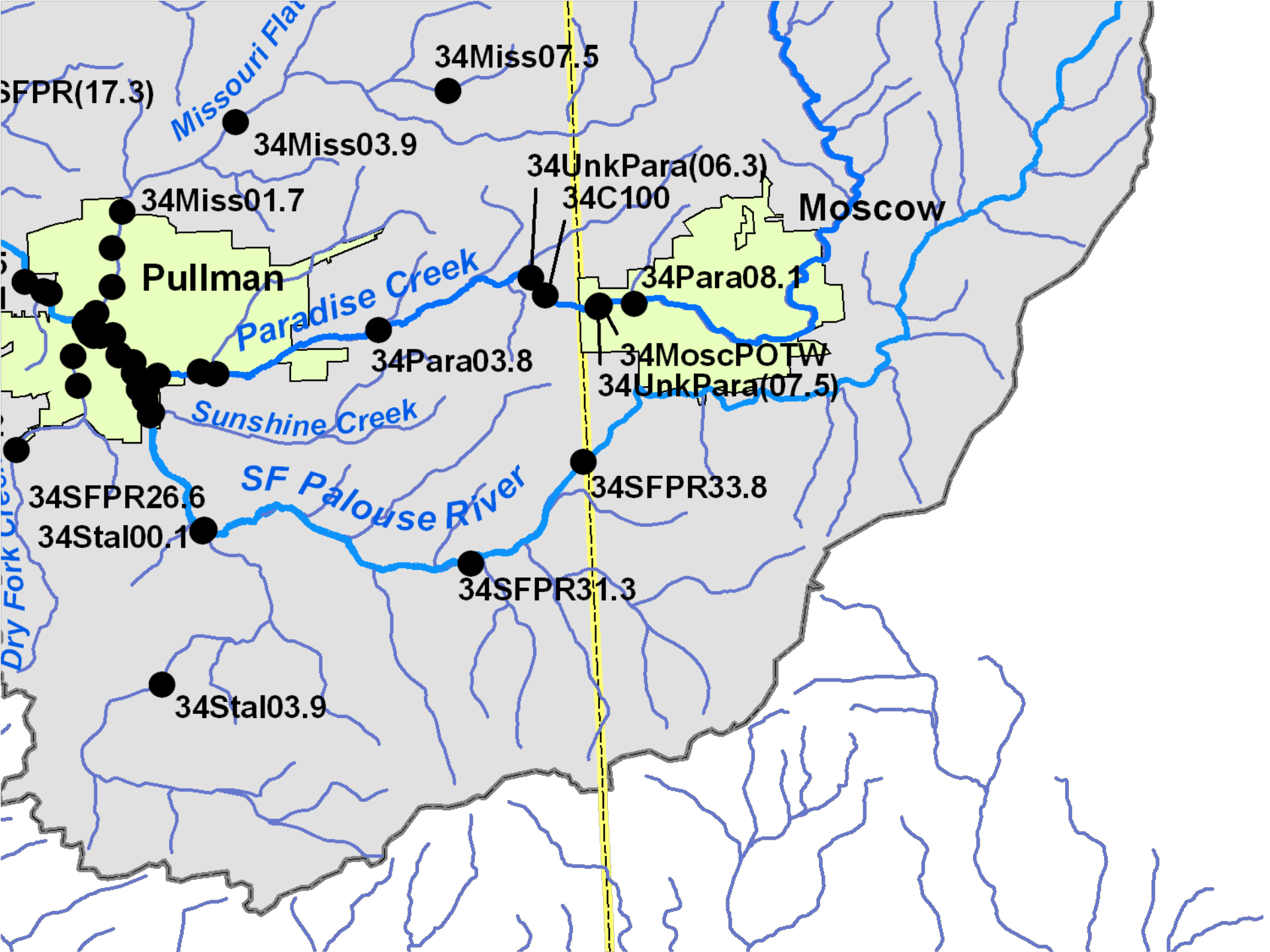

MISSOURI CREEK: dry season TSS loads
Avg. load from storm drains
Avg. non-point load in reach
Avg. end of reach load
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
25
20
15
10
5
0
1.0
0.8
0.6
0.4
0.2
0.0
*
above RM 3.9
RM 3.9 to 1.7
storm drain 60
RM 1.7 to 0.8
storm drain 120
RM 0.8 to 0.1
* no measurable load


MISSOURI FLAT CREEK: wet season FC loads
Avg. load from storm drains
Avg. non-point load in reach
Avg. end of reach load
Avg. flow at end of reach
FC load
Flow (cfs)
1200
1000
800
600
400
200
0
18
15
12
9
6
3
0
*
*
above RM 7.5
RM 7.5 to 3.9
RM 3.9 to 1.7
storm drain 60
RM 1.7 to 0.8
storm drain 120
RM 0.8 to 0.1
* no apparent non-point load


Wet season
% load contribution
31% from near stateline
Pullman
Missouri Flat Creek
Airport Road Creek
Paradise Creek
11%
34Miss01.7
0.2%
34MissSD60
0%
34Miss00.8
34MissSD120
21%
34PullPOTW
adl00.1
SFPR22.0
37%
34MissSD210
34MissSD200
0.2%
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0

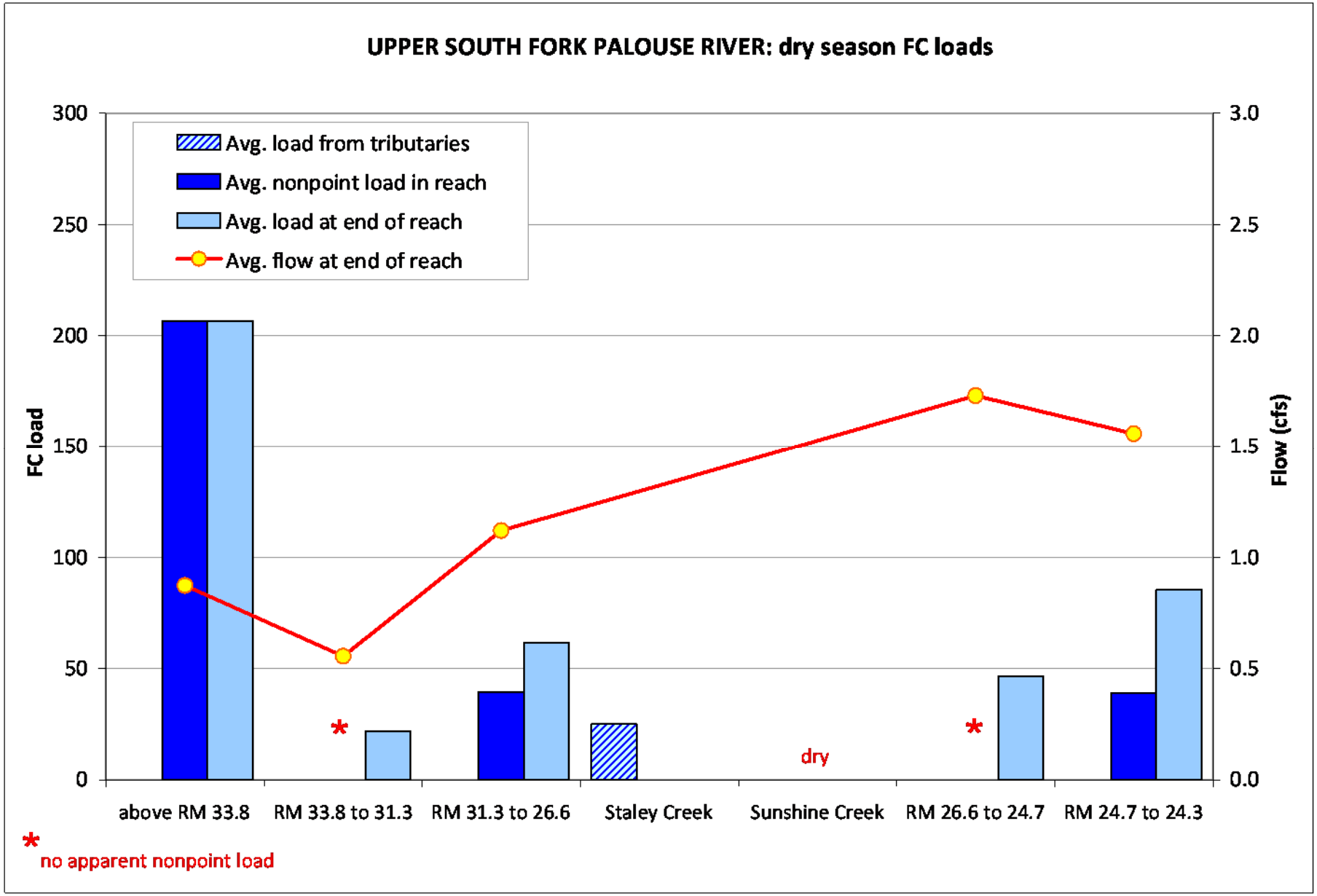


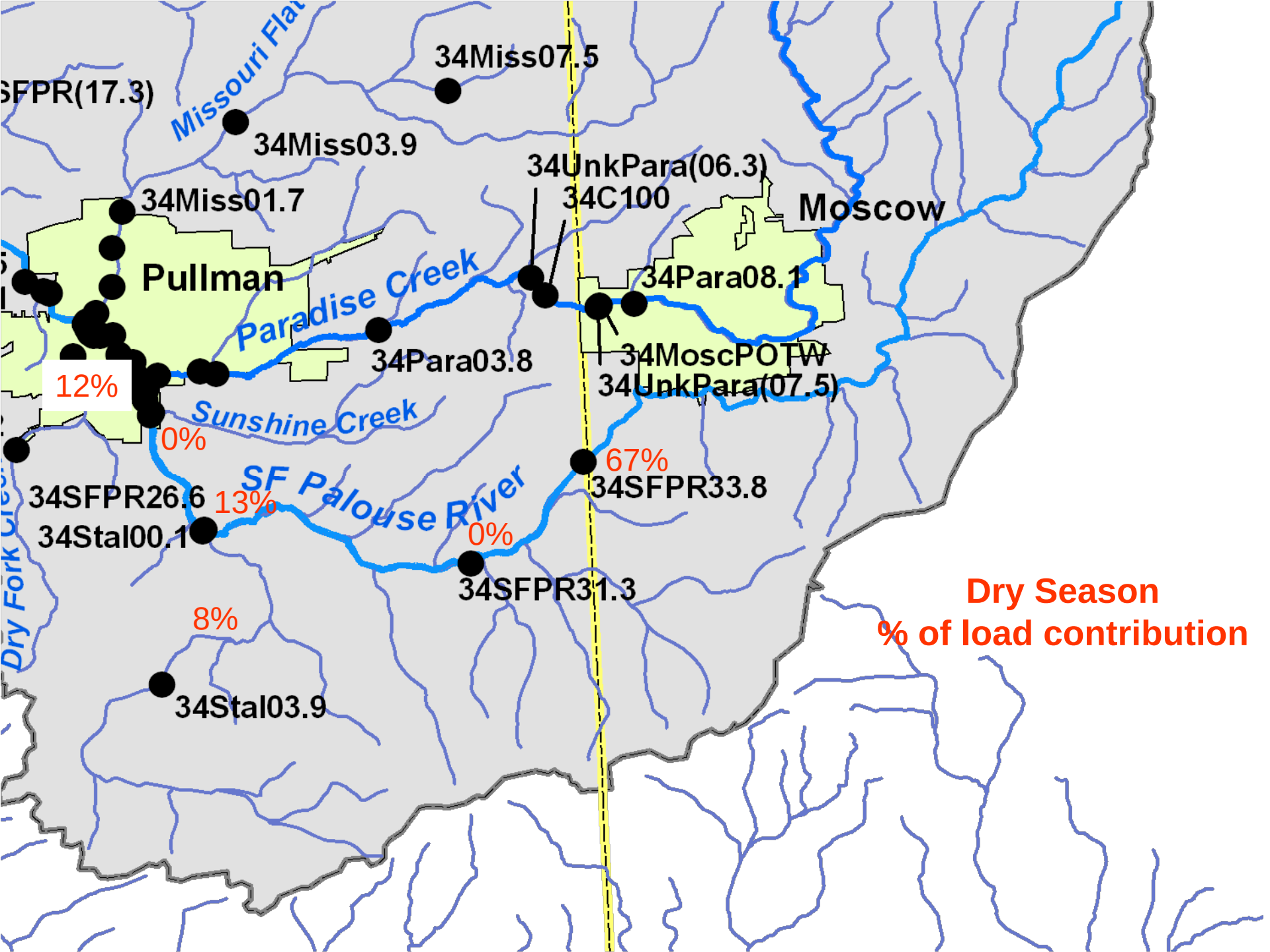
* no apparent non-point load or storm drain

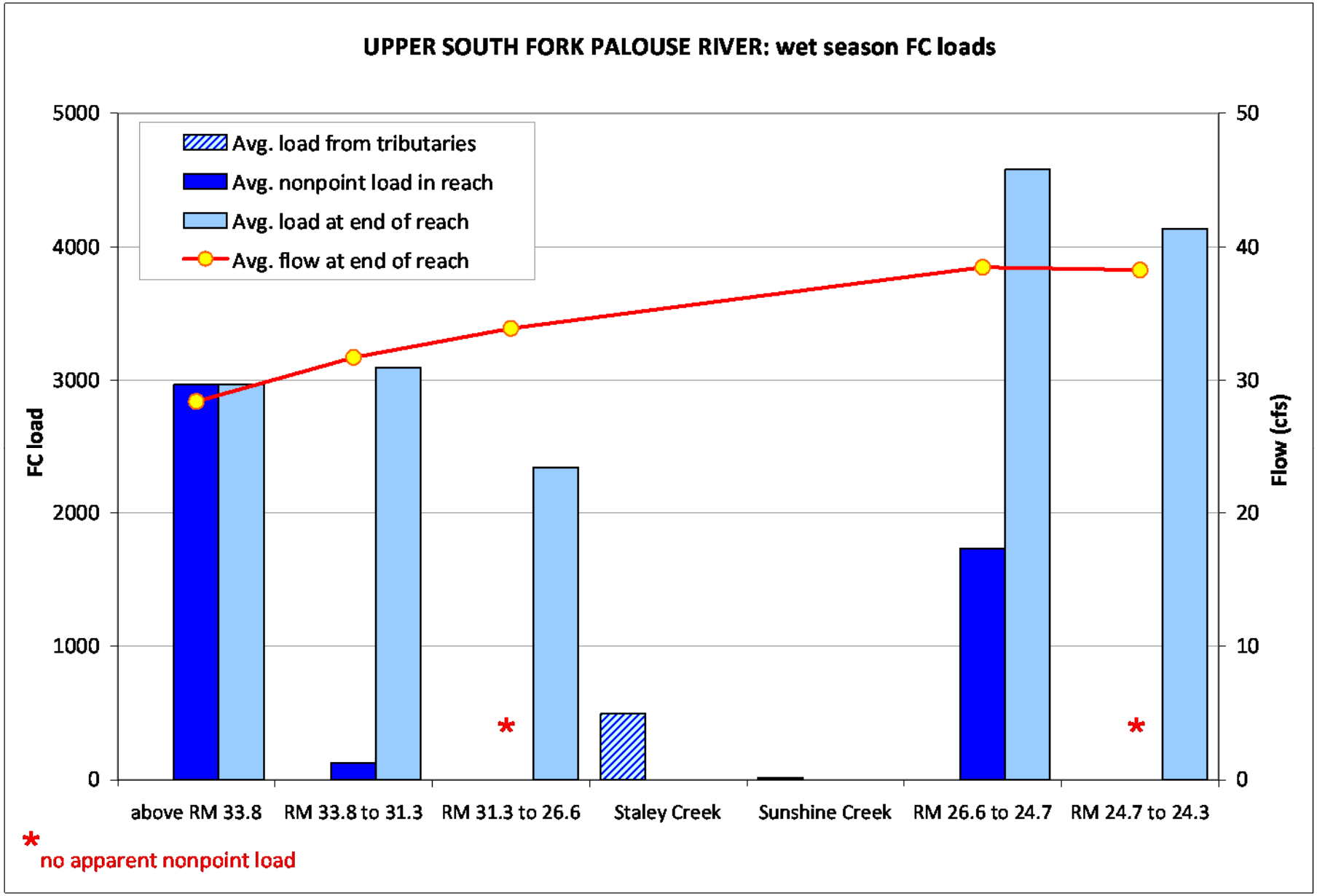

SFPR(17.3)
Missouri Flat
34Miss07.5
34Miss03.9
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
Sunshine Creek
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
34SFPR31.3
Dry Fork Cre
34Stal03.9

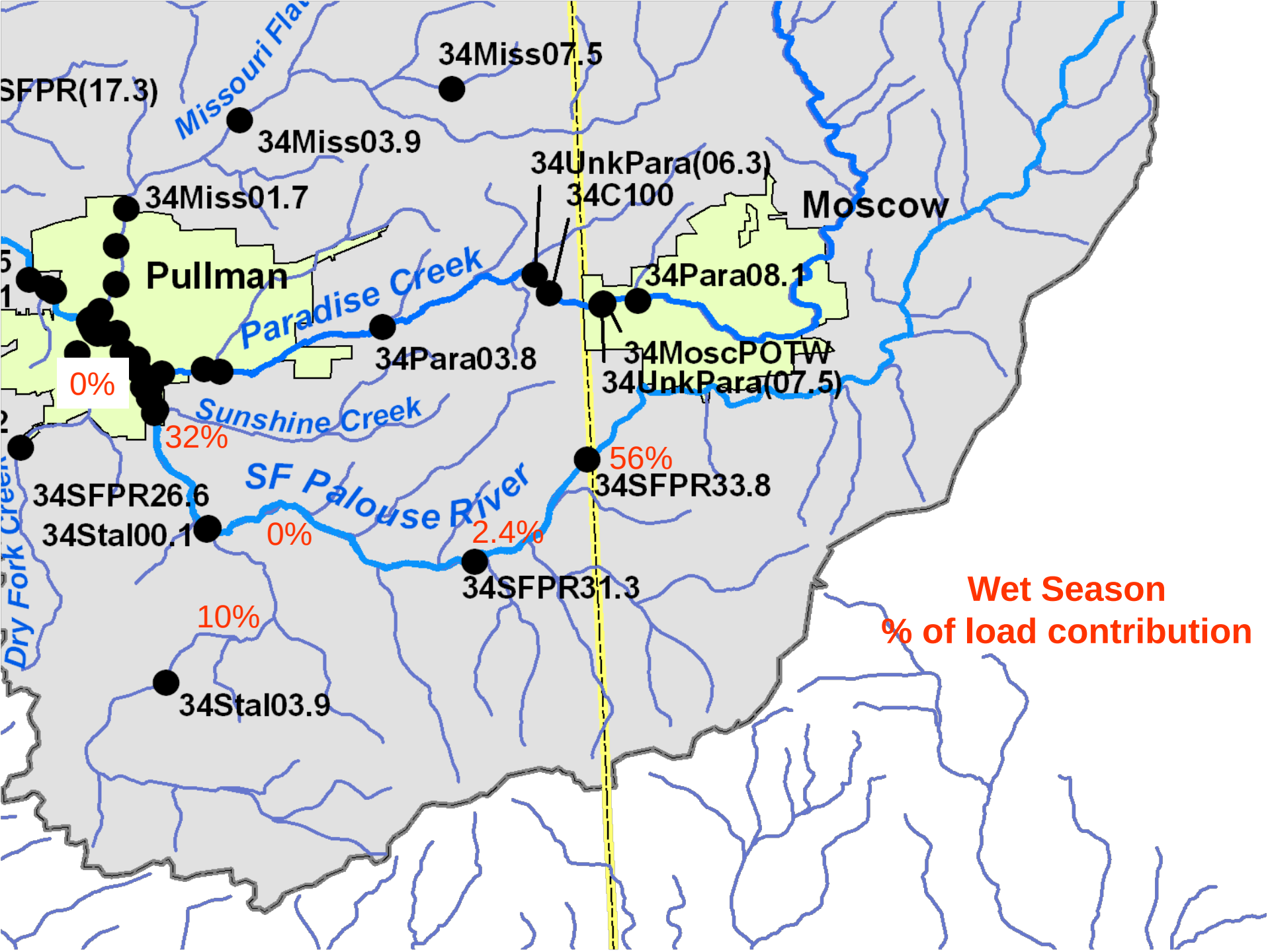
Upper South Fork Palouse River and tributaries								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34SFPR33.8	12	27	30	73	175	200	8%	**0%**
34SFPR31.3	10	27	26	67	170	270	10%	**0%**
34SFPR26.6	12	1	2	31	509	4400	8%	**61%**
34Stal00.1	10	20	15	149	1487	11000	40%	**87%**
34Sun00.0	10	2	1	13	213	2600	10%	**6%**
34SFPR-SD360	11	1	1	5	39	100	0%	**0%**
34SFPR24.7	13	6	11	86	677	2100	38%	**70%**
34SFPR24.3	17	3	6	52	427	2500	24%	**53%**
	DRY SEASON							
34SFPR33.8	10	100	87	357	1460	1900	60%	**86%**
34SFPR31.3	11	2	4	21	104	170	0%	**0%**
34SFPR26.6	12	2	4	24	155	110	0%	**0%**
34Stal00.1	8	9	9	98	1020	2000	25%	**80%**
34Sun00.0	1	7	----	7	----	7	----	**0%**
34SFPR-SD360	6	1	2	11	75	38	0%	**0%**
34SFPR24.7	10	3	4	22	115	130	0%	**0%**
34SFPR24.3	14	2	3	30	335	720	21%	**40%**

*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season


UPPER SOUTH FORK PALOUSE RIVER: dry season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
300
250
200
150
100
50
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
*
*
dry
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
* no apparent nonpoint load


SFPR(17.3)
Missouri Flat
34Miss07.5
34Miss03.9
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
12%
Sunshine Creek
0%
67%
34SFPR33.8
SF Palouse River
34SFPR26.6
13%
34Stal00.1
0%
34SFPR31.3
Dry Fork Creek
8%
34Stal03.9
Dry Season
% of load contribution

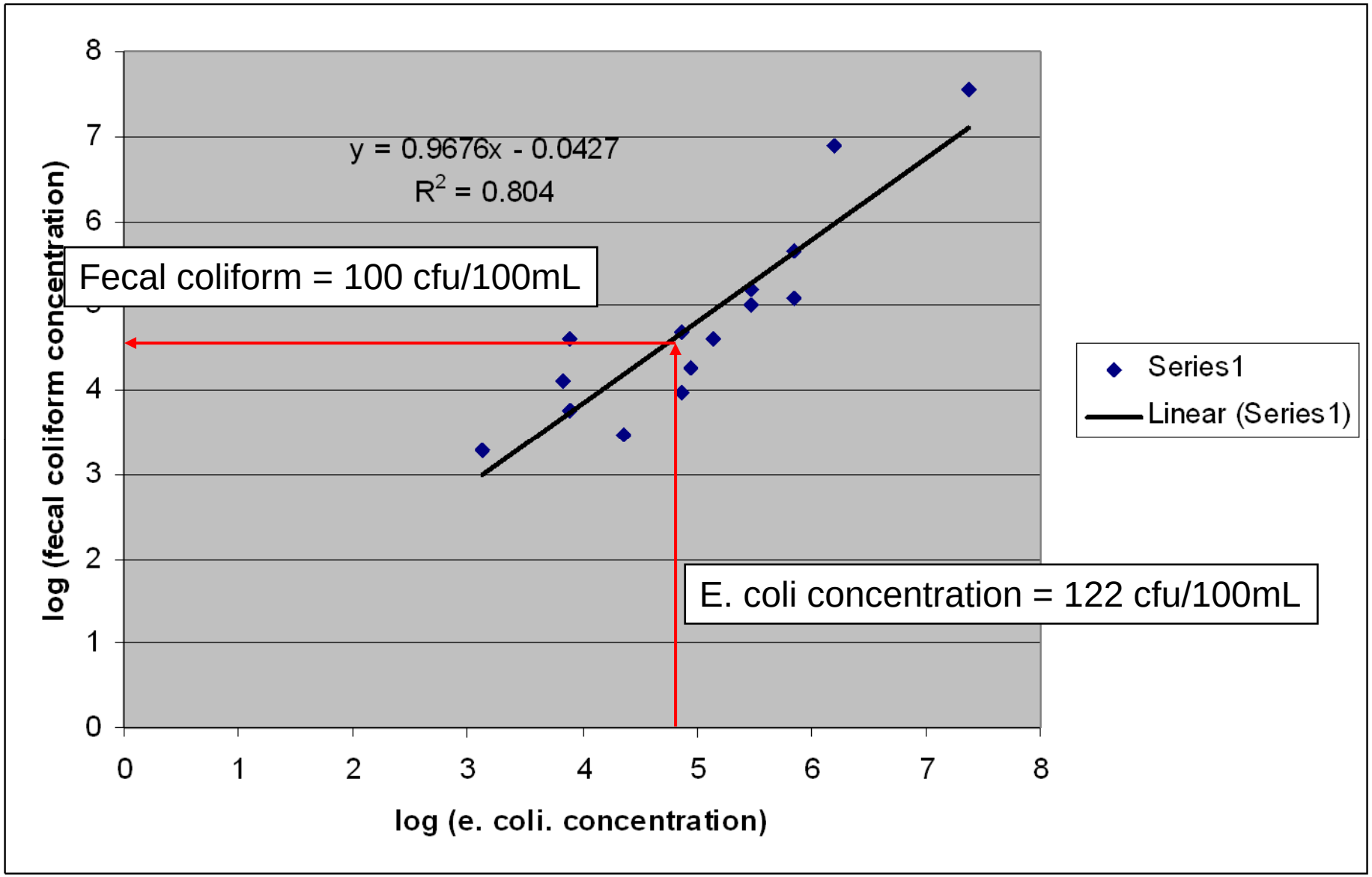

UPPER SOUTH FORK PALOUSE RIVER: wet season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
5000
4000
3000
2000
1000
0
50
40
30
20
10
0
*
*
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
* no apparent nonpoint load


Missouri Flat
SFPR(17.3)
34Miss07.5
34Miss03.9
34UnkPara(06.3)
34C100
34Miss01.7
Moscow
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
0%
Sunshine Creek
32%
56%
34SFPR33.8
SF Palouse River
34SFPR26.6
34Stal00.1
0%
2.4%
34SFPR31.3
Dry Fork Creek
10%
34Stal03.9
Wet Season
% of load contribution

Upper South Fork Palouse River and tributaries								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34SFPR33.8	12	27	30	73	175	200	8%	**0%**
34SFPR31.3	10	27	26	67	170	270	10%	**0%**
34SFPR26.6	12	1	2	31	509	4400	8%	**61%**
34Stal00.1	10	20	15	149	1487	11000	40%	**87%**
34Sun00.0	10	2	1	13	213	2600	10%	**6%**
34SFPR-SD360	11	1	1	5	39	100	0%	**0%**
34SFPR24.7	13	6	11	86	677	2100	38%	**70%**
34SFPR24.3	17	3	6	52	427	2500	24%	**53%**
	DRY SEASON							
34SFPR33.8	10	100	87	357	1460	1900	60%	**86%**
34SFPR31.3	11	2	4	21	104	170	0%	**0%**
34SFPR26.6	12	2	4	24	155	110	0%	**0%**
34Stal00.1	8	9	9	98	1020	2000	25%	**80%**
34Sun00.0	1	7	----	7	----	7	----	**0%**
34SFPR-SD360	6	1	2	11	75	38	0%	**0%**
34SFPR24.7	10	3	4	22	115	130	0%	**0%**
34SFPR24.3	14	2	3	30	335	720	21%	**40%**

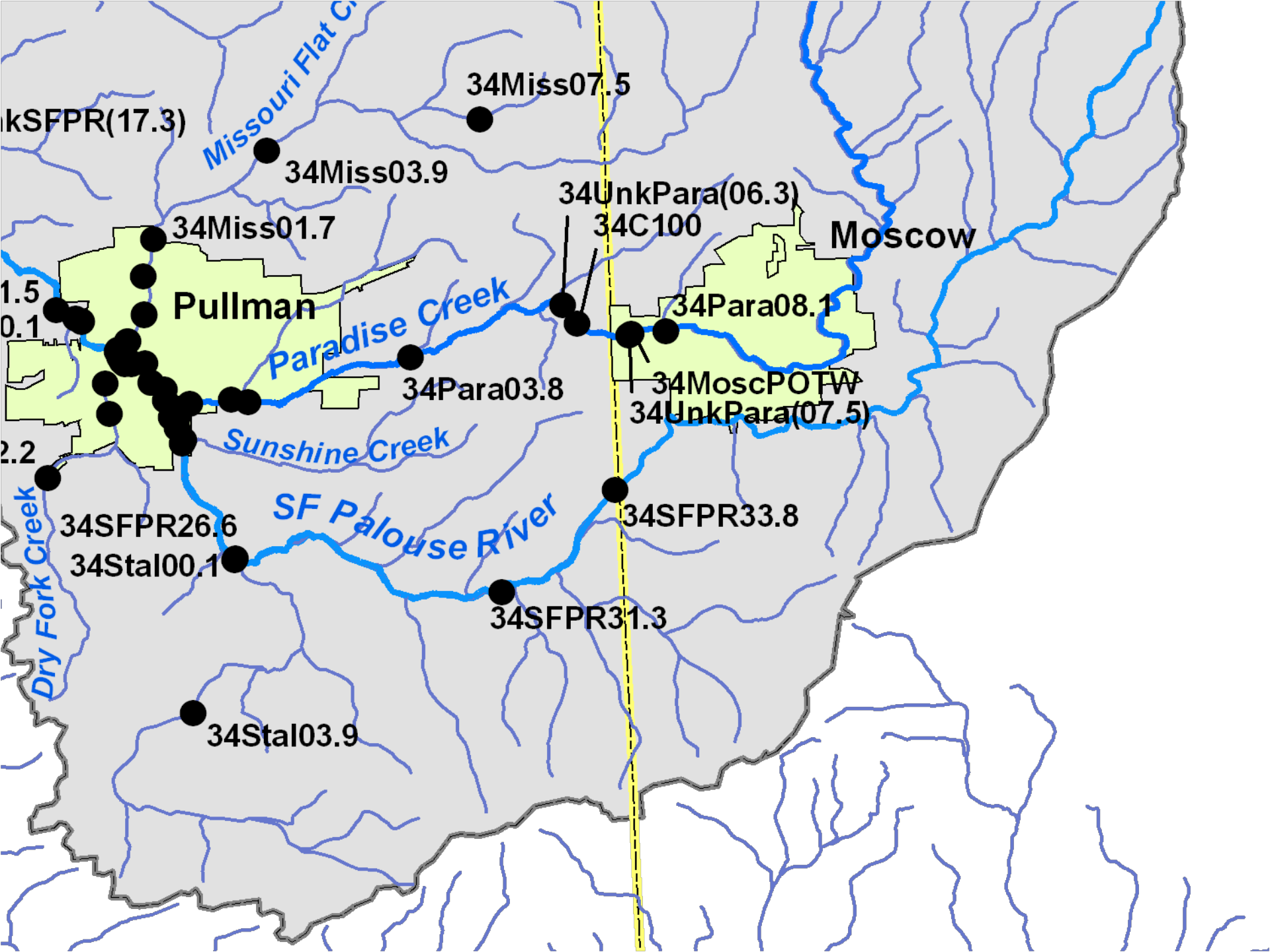
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

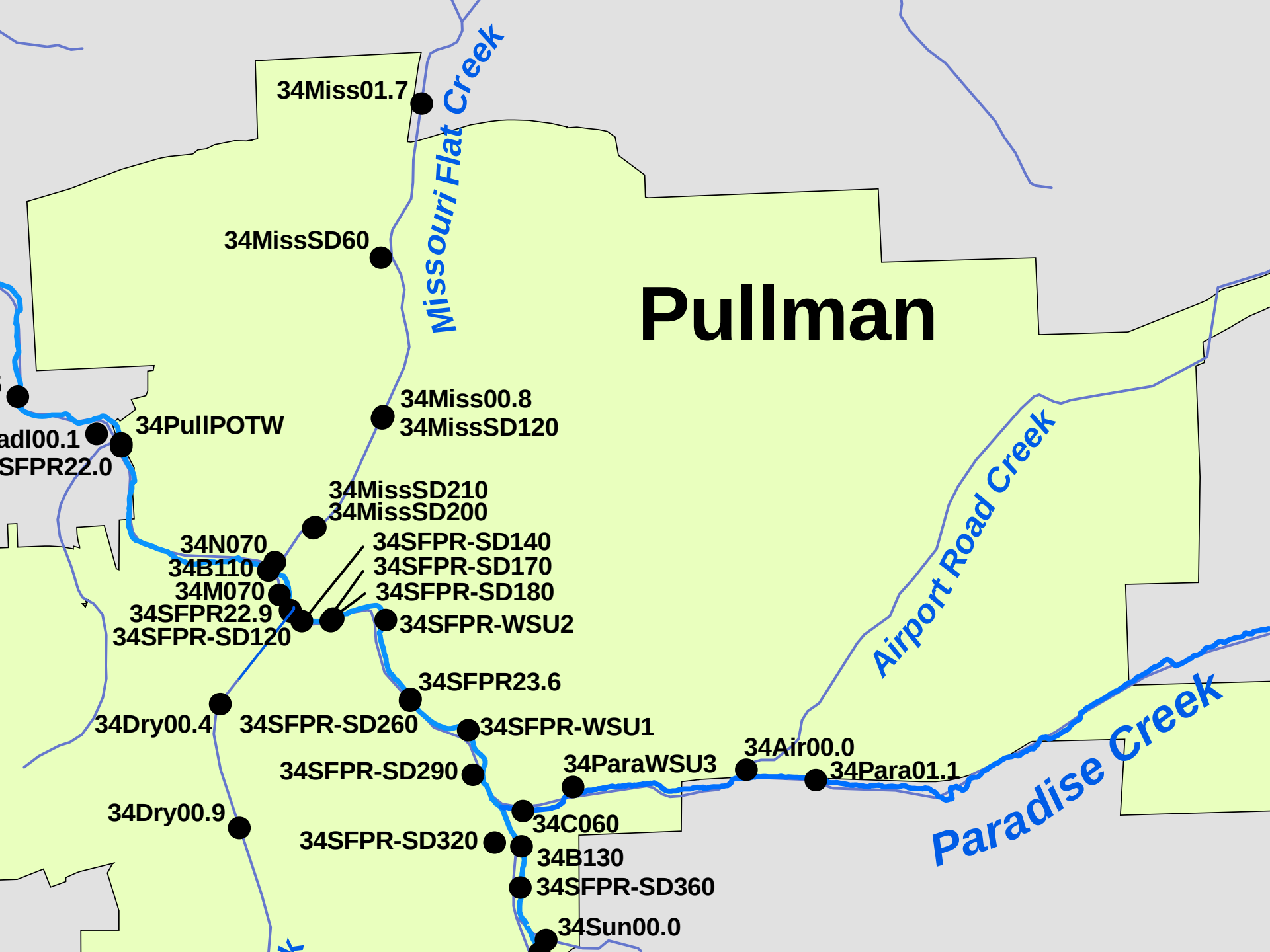
SF Palouse River at WA/ID state-line
Comparison of E. coli and Fecal coliform concentrations



State line summary on SF Palouse River

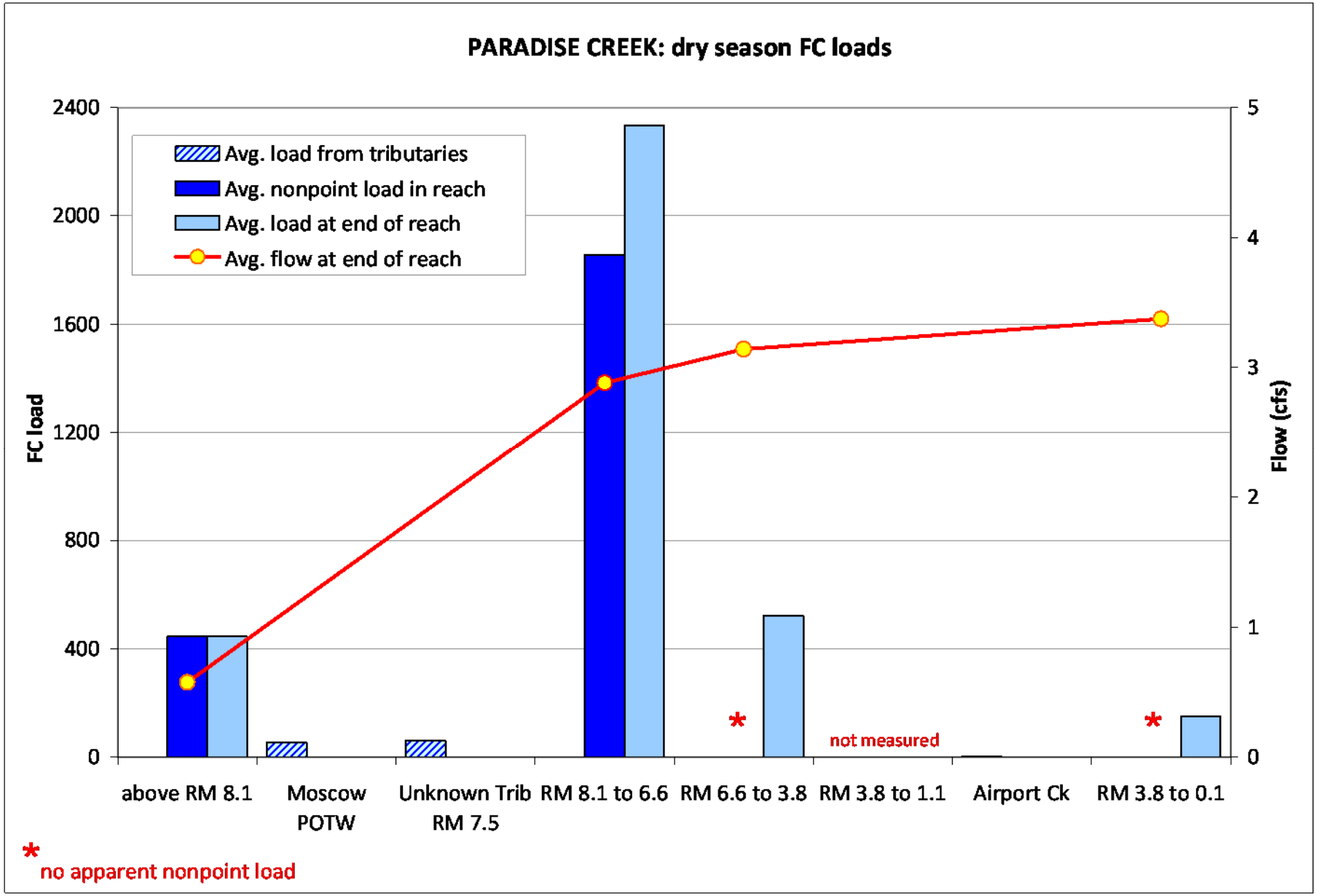
- Idaho has an E. coli standard of 126 cfu/100mL for the SF Palouse River.
- Washington has a two-part fecal coliform water quality standard.
- Idaho TMDL for the SF Palouse is requiring a 41% reduction of E. coli (year-round) at the stateline to meet the Idaho standard.
- Ecology would require an 86% reduction in FC bacteria at the state line to meet WA standards during the dry season,
- and a load reduction to improve downstream water quality in the wet season.

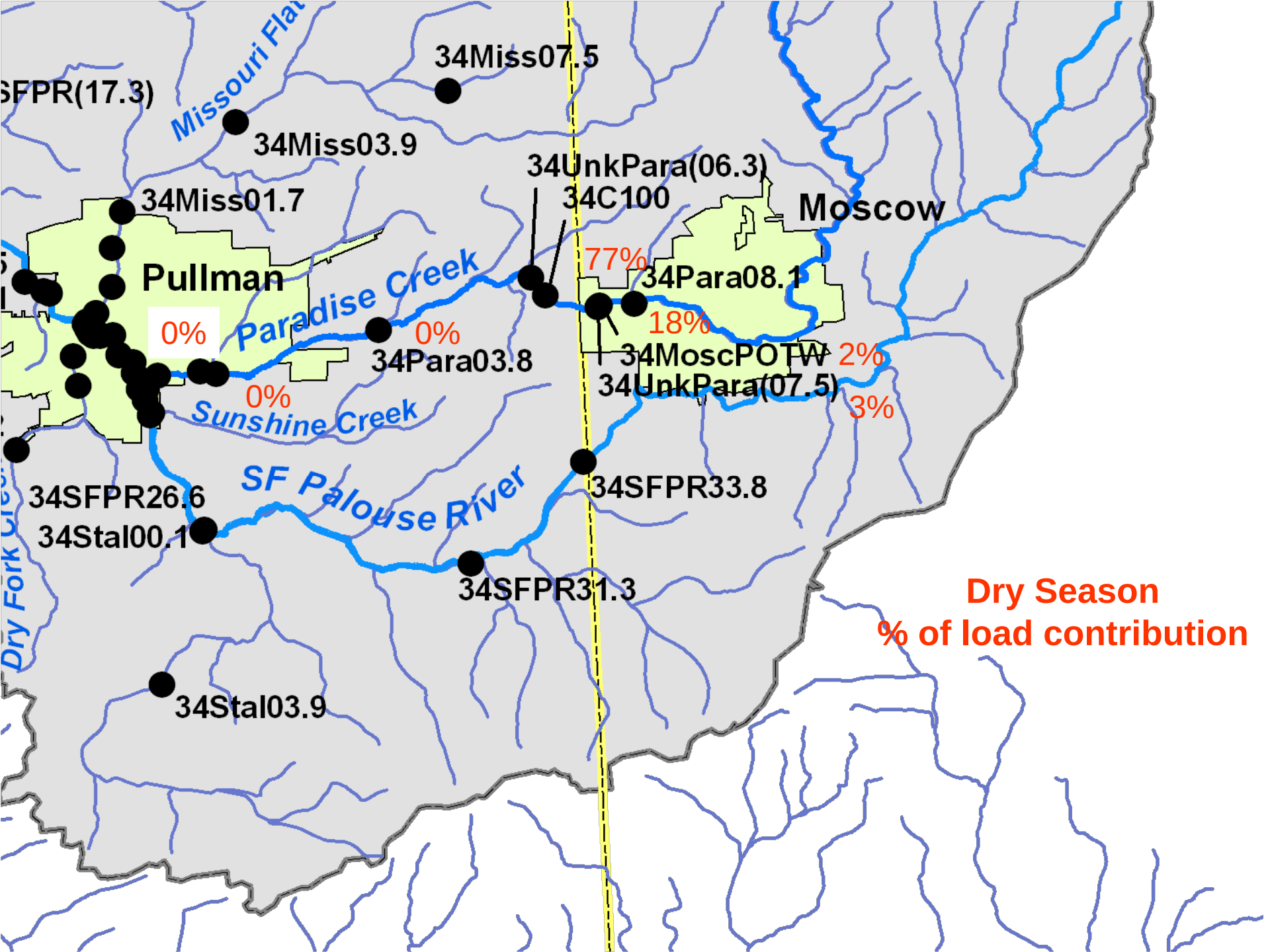

kSFPR(17.3)
Missouri Flat C
34Miss07.5
34Miss03.9
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
1.5
0.1
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
Sunshine Creek
2.2
Dry Fork Creek
34SFPR26.6
34Stal00.1
SF Palouse River
34SFPR33.8
34SFPR31.3
34Stal03.9

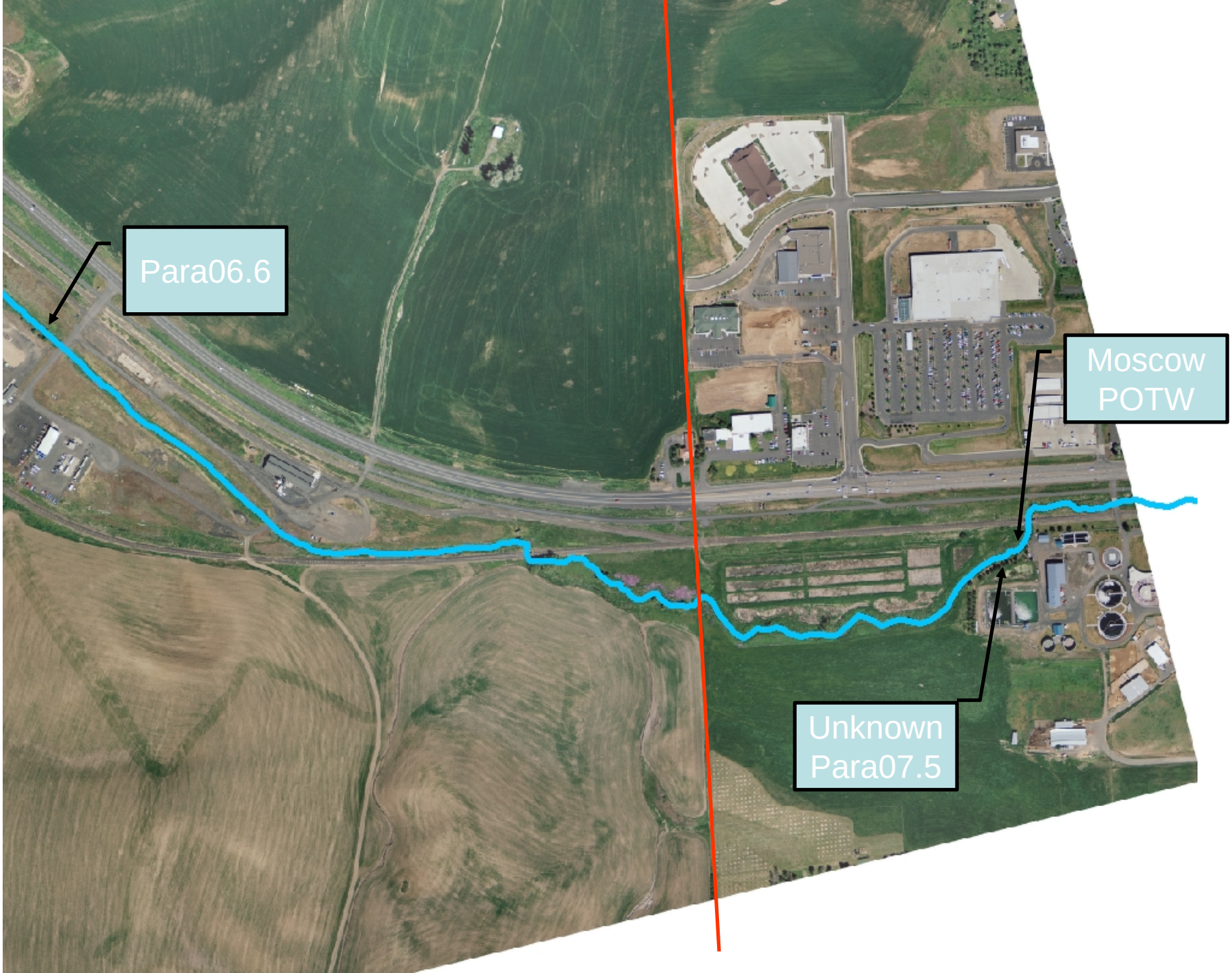

Pullman
Missouri Flat Creek
Airport Road Creek
Paradise Creek
34Miss01.7
34MissSD60
34Miss00.8
34MissSD120
34PullPOTW
adl00.1
SFPR22.0
34MissSD210
34MissSD200
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0

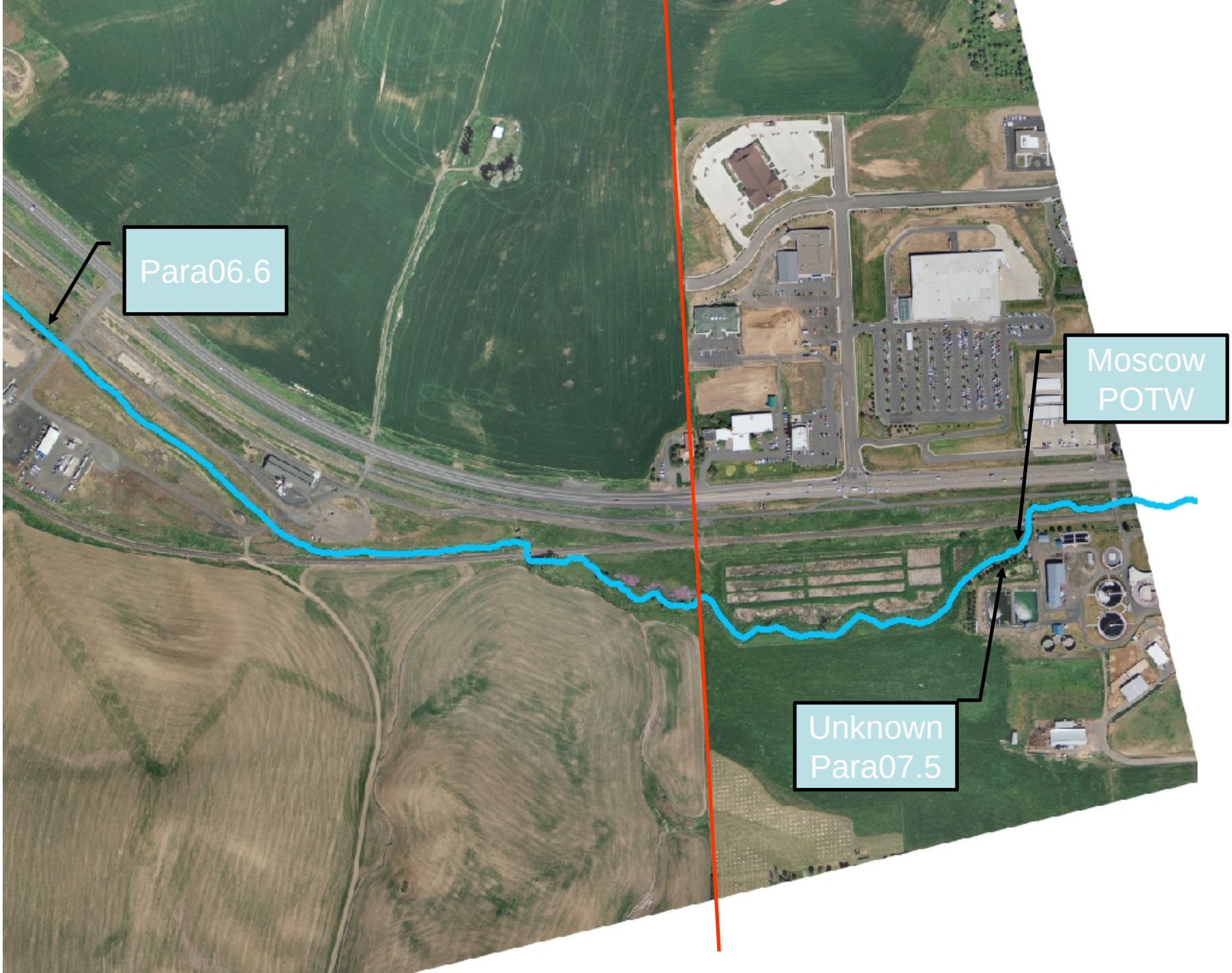
Paradise Creek								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34Para08.1	13	3	20	98	488	445	23%	**59%**
34MoscPOTW	11	1	1	4	14	24	0%	**0%**
34UnkPara(07.5)	8	3	7	90	1164	800	63%	**83%**
34Para06.6	15	24	18	156	1350	4400	27%	**85%**
34UnkPara(06.3)	9	1	0	7	151	640	11%	**0%**
34Para03.8	12	4	4	36	326	460	17%	**39%**
34Air00.0	12	9	9	106	1282	4500	50%	**84%**
34Para01.1	11	6	4	34	324	480	18%	**38%**
34ParaWSU3	11	1	0	4	82	460	9%	**0%**
34Para00.1	14	3	3	32	320	930	14%	**37%**
	DRY SEASON							
34Para08.1	11	84	64	508	4038	7500	64%	**95%**
34MoscPOTW	7	3	2.4	29	351	640	14%	**43%**
34UnkPara(07.5)	0	----	----	----	----	----	----	**----**
34Para06.6	13	20	45	324	2321	5700	69%	**91%**
34UnkPara(06.3)	1	3	----	----	----	3	----	**0%**
34Para03.8	11	11	29	194	1276	2800	64%	**84%**
34Air00.0	7	1	4.6	115	2908	1700	43%	**93%**
34Para01.1	6	9	5.6	66	777	1800	17%	**74%**
34ParaWSU3	5	1	0.4	3	29	44	0%	**0%**
34Para00.1	12	4	6.1	55	492	1700	17%	**59%**

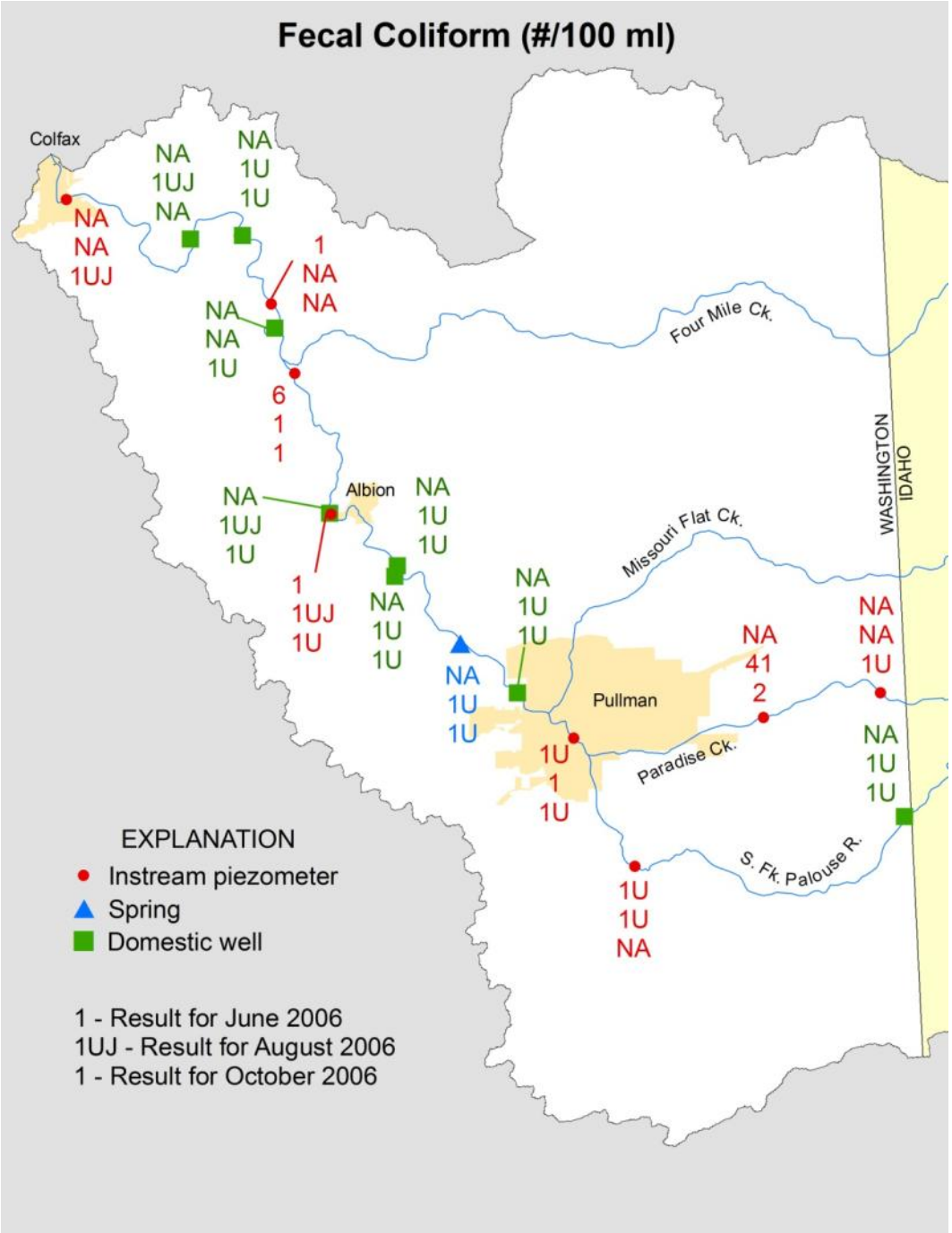
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season


PARADISE CREEK: dry season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
2400
2000
1600
1200
800
400
0
5
4
3
2
1
0
*
not measured
*
above RM 8.1
Moscow POTW
Unknown Trib RM 7.5
RM 8.1 to 6.6
RM 6.6 to 3.8
RM 3.8 to 1.1
Airport Ck
RM 3.8 to 0.1
* no apparent nonpoint load


SFPR(17.3)
Missouri Flat
34Miss07.5
34Miss03.9
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
Pullman
Paradise Creek
77%
34Para08.1
18%
0%
0%
34Para03.8
34MoscPOTW
2%
34UnkPara(07.5)
3%
0%
Sunshine Creek
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
34SFPR31.3
Dry Fork Cre
34Stal03.9
Dry Season
% of load contribution


Para06.6
Moscow
POTW
Unknown
Para07.5


Para06.6
Moscow
POTW
Unknown
Para07.5


Fecal Coliform (#/100 ml)
Colfax
NA
1UJ
NA
NA
1U
1U
NA
NA
1UJ
1
NA
NA
NA
NA
1U
6
1
1
Four Mile Ck.
Albion
NA
1UJ
1U
NA
1U
1U
1
1UJ
1U
NA
1U
1U
NA
1U
1U
NA
1U
1U
Missouri Flat Ck.
WASHINGTON
IDAHO
NA
NA
1U
NA
41
2
Pullman
1U
1
1U
Paradise Ck.
NA
1U
1U
S. Fk. Palouse R.
1U
1U
NA
EXPLANATION
Instream piezometer
Spring
Domestic well
1 - Result for June 2006
1UJ - Result for August 2006
1 - Result for October 2006

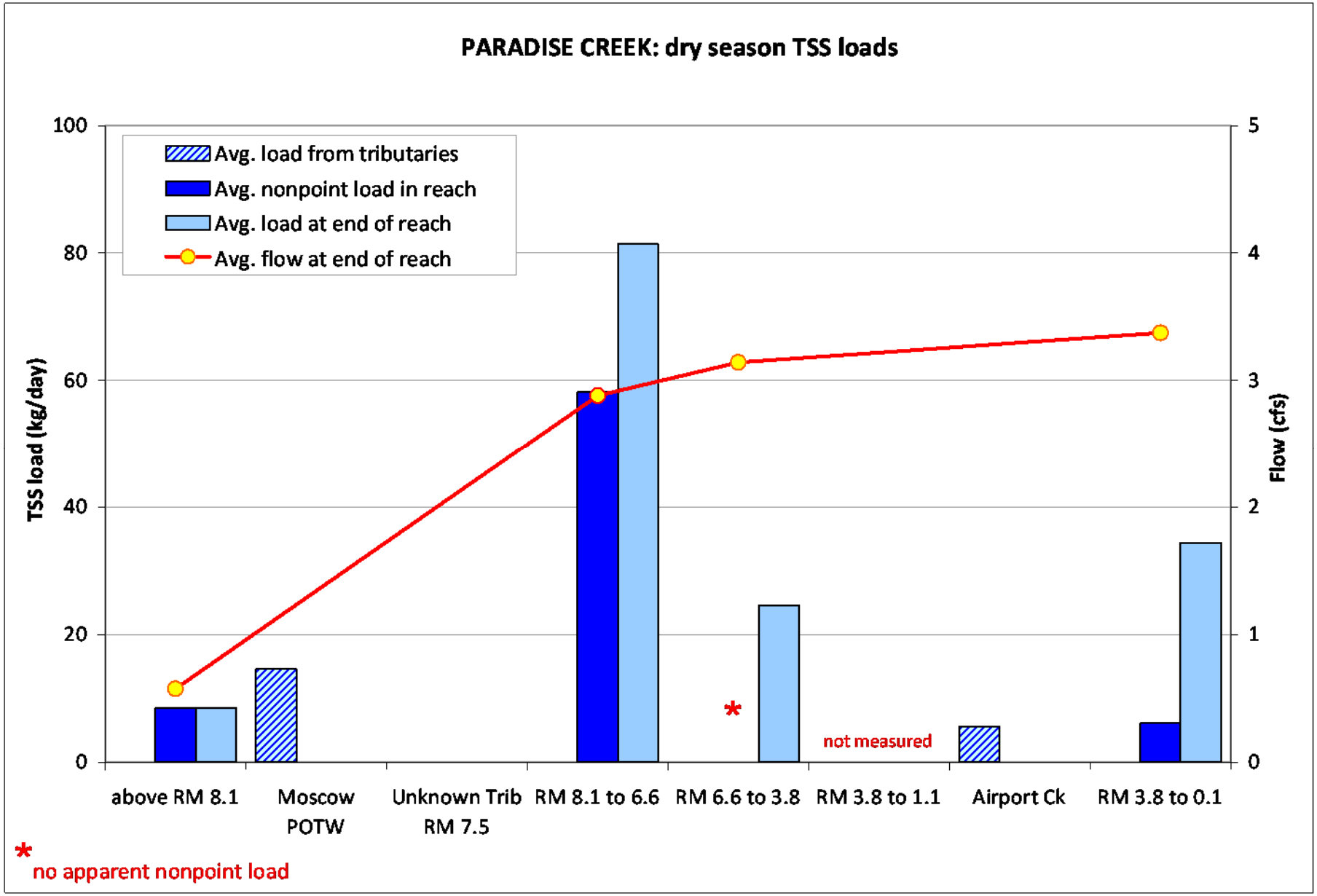
Other possible load sources at the state line on Paradise

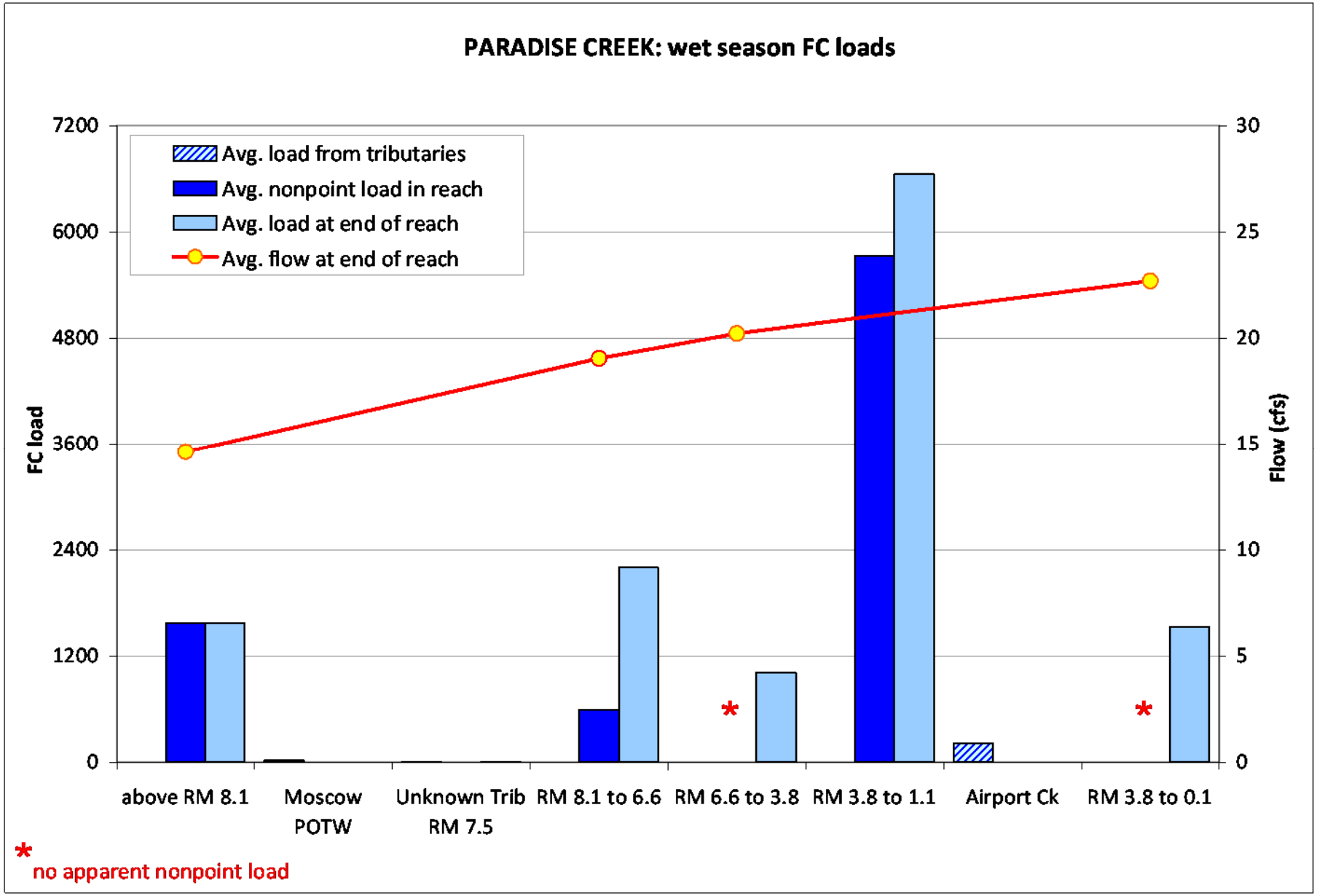
- Non-point loads from developments (contaminated non-stormwater discharge or septic system failure)

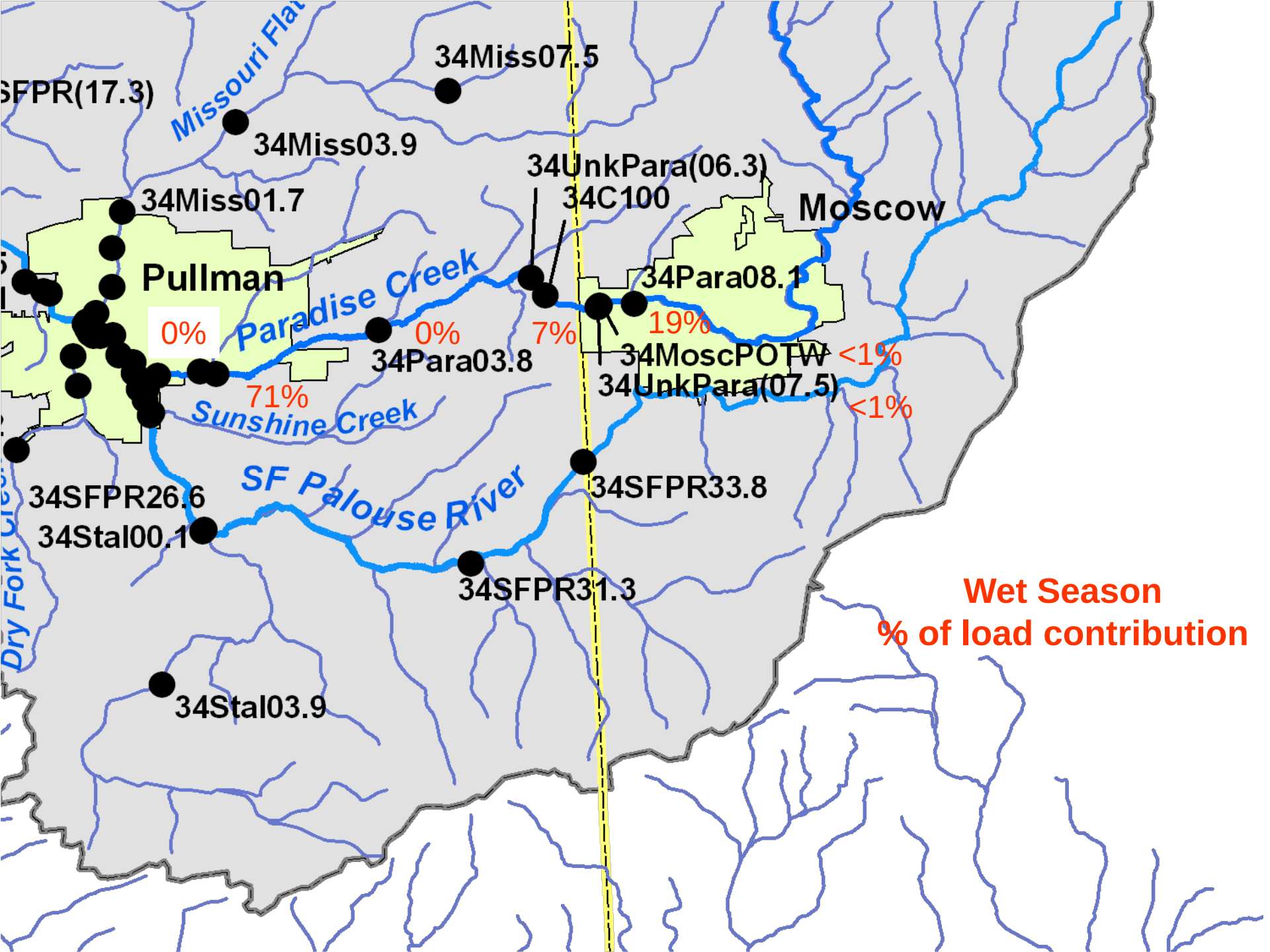
- Resuspension of bacteria from sediments (increase in total suspended solids also seen)

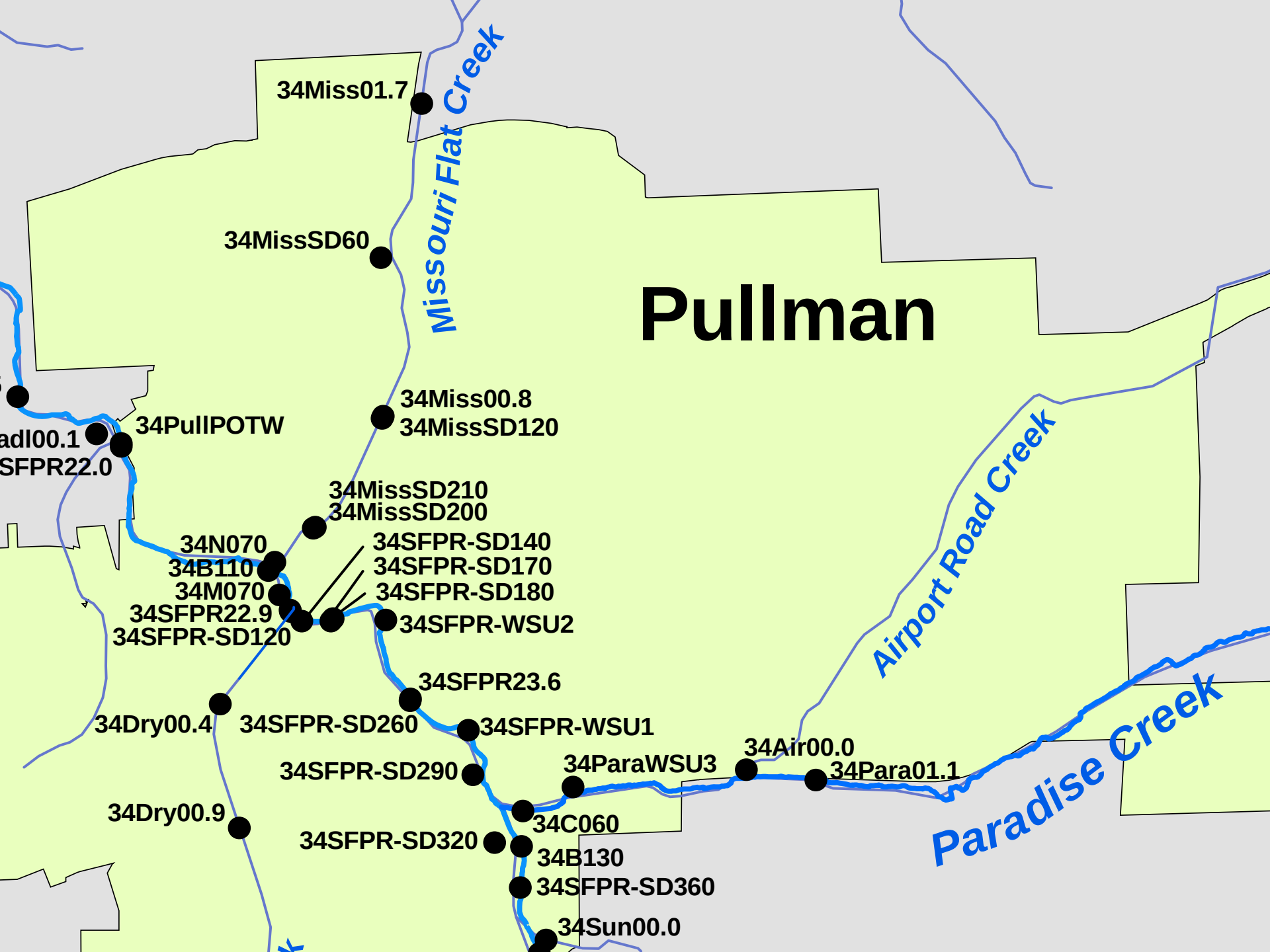
- Error in measuring the known loads

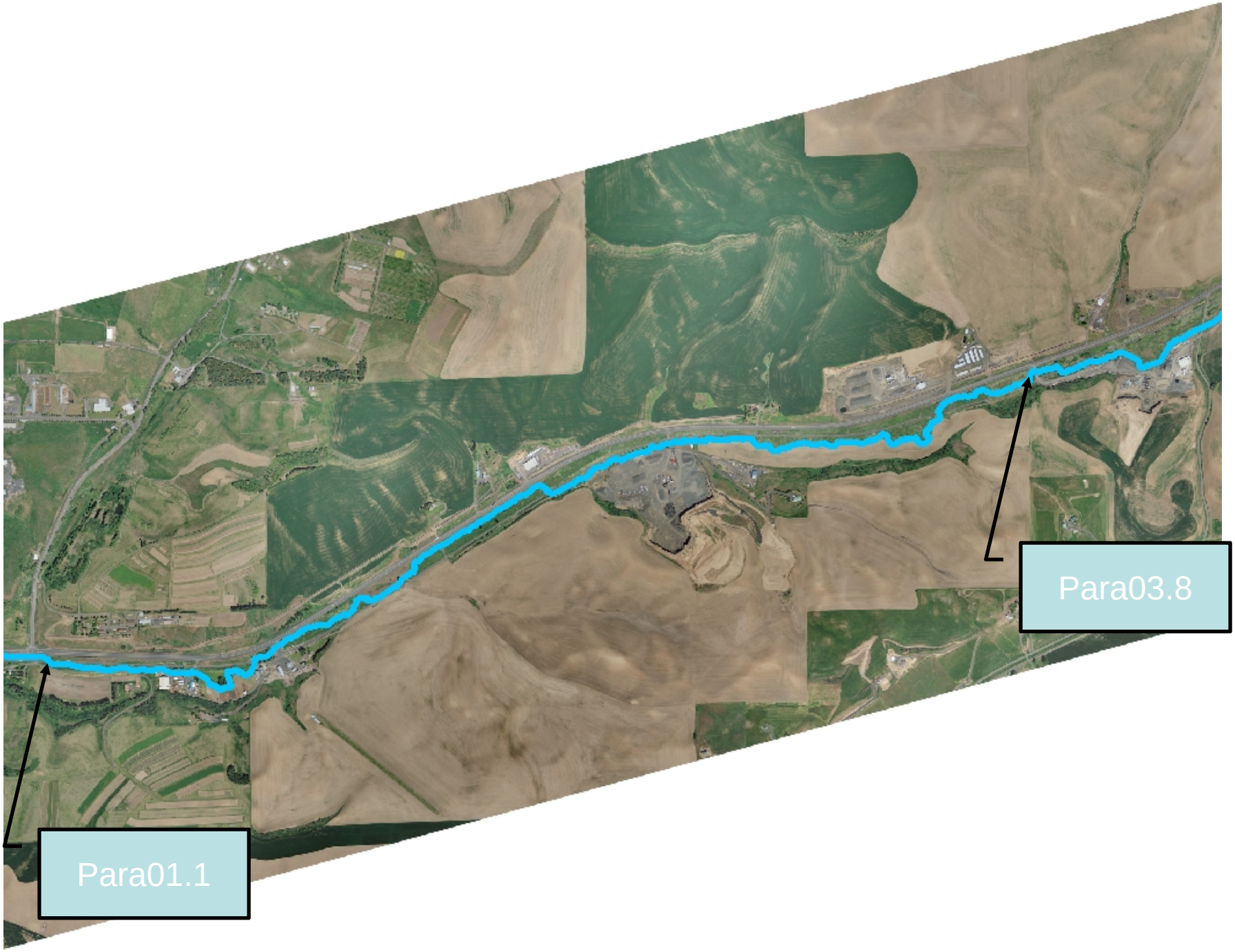
SCHUCK'S


PARADISE CREEK: dry season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
100
80
60
40
20
0
5
4
3
2
1
0
*
not measured
above RM 8.1
Moscow POTW
Unknown Trib RM 7.5
RM 8.1 to 6.6
RM 6.6 to 3.8
RM 3.8 to 1.1
Airport Ck
RM 3.8 to 0.1
* no apparent nonpoint load

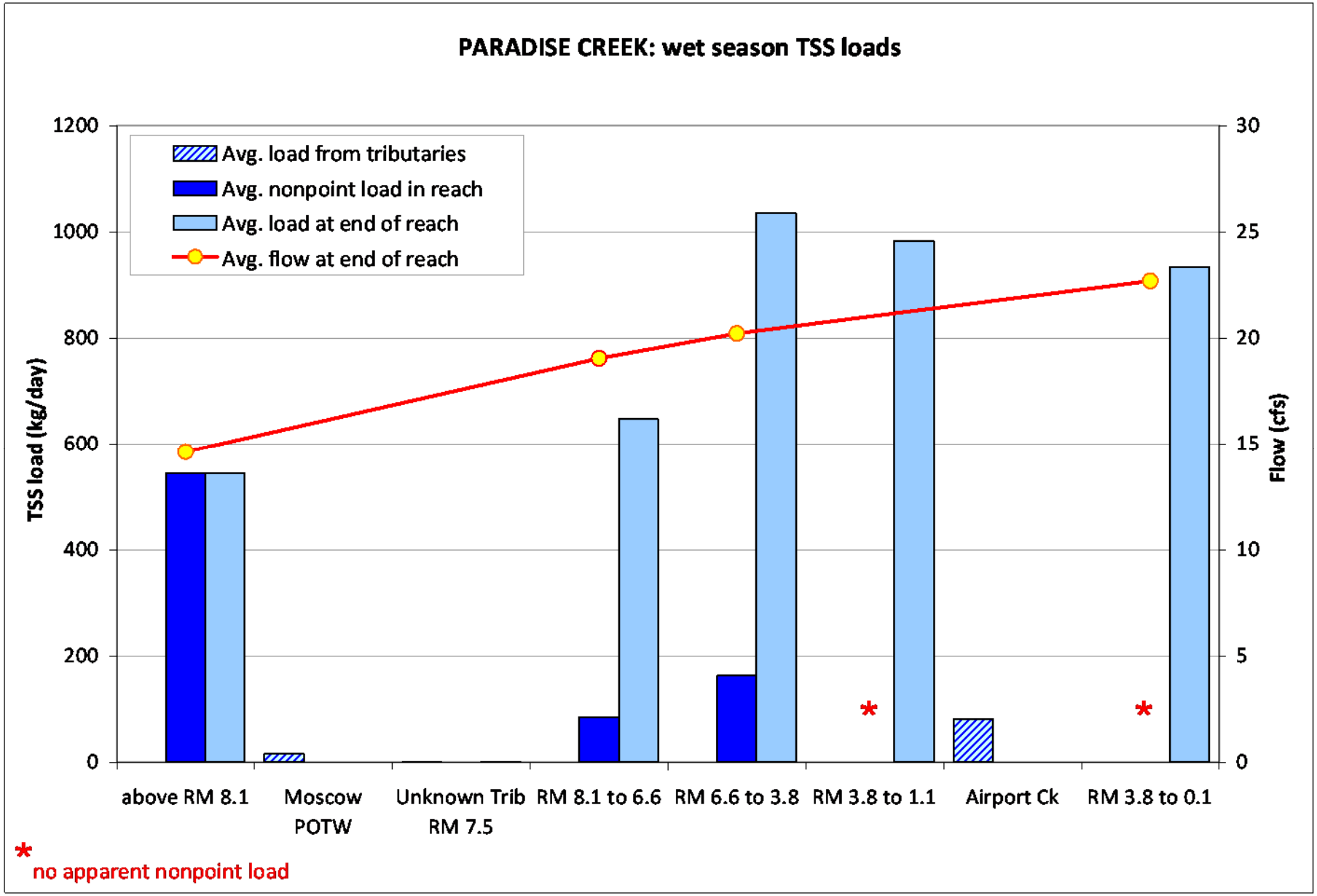

PARADISE CREEK: wet season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
7200
6000
4800
3600
2400
1200
0
30
25
20
15
10
5
0
*
*
above RM 8.1
Moscow POTW
Unknown Trib RM 7.5
RM 8.1 to 6.6
RM 6.6 to 3.8
RM 3.8 to 1.1
Airport Ck
RM 3.8 to 0.1
* no apparent nonpoint load


34Miss07.5
SFPR(17.3)
Missouri Flat
34Miss03.9
34UnkPara(06.3)
34C100
34Miss01.7
Moscow
Pullman
Paradise Creek
34Para08.1
0%
0%
7%
19%
34Para03.8
34MoscPOTW
<1%
34UnkPara(07.5)
71%
<1%
Sunshine Creek
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
34SFPR31.3
Dry Fork Cre
34Stal03.9
Wet Season
% of load contribution


Pullman
Missouri Flat Creek
Airport Road Creek
Paradise Creek
34Miss01.7
34MissSD60
34Miss00.8
34MissSD120
34PullPOTW
adl00.1
SFPR22.0
34MissSD210
34MissSD200
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
34Sun00.0

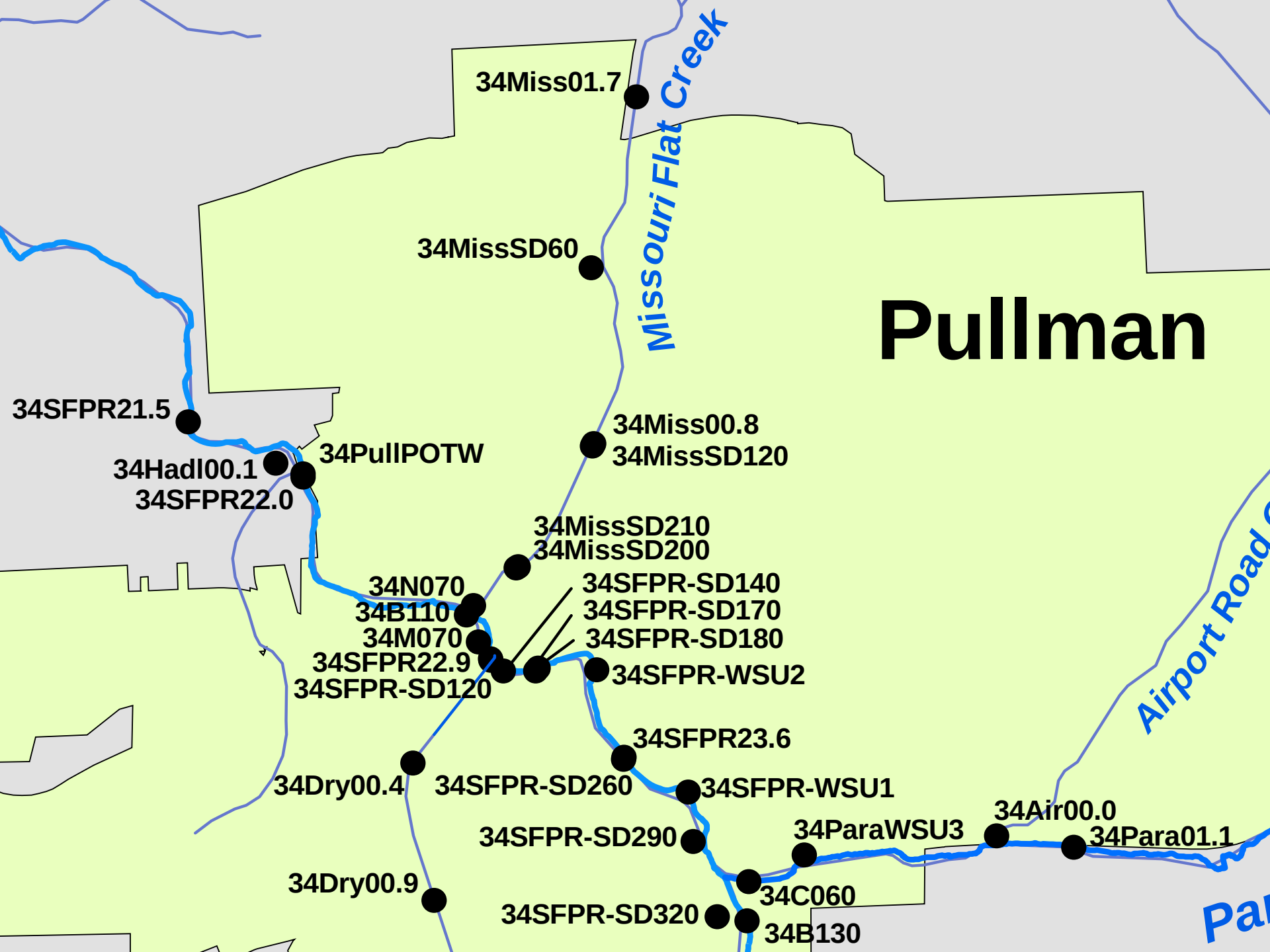

Para03.8
Para01.1

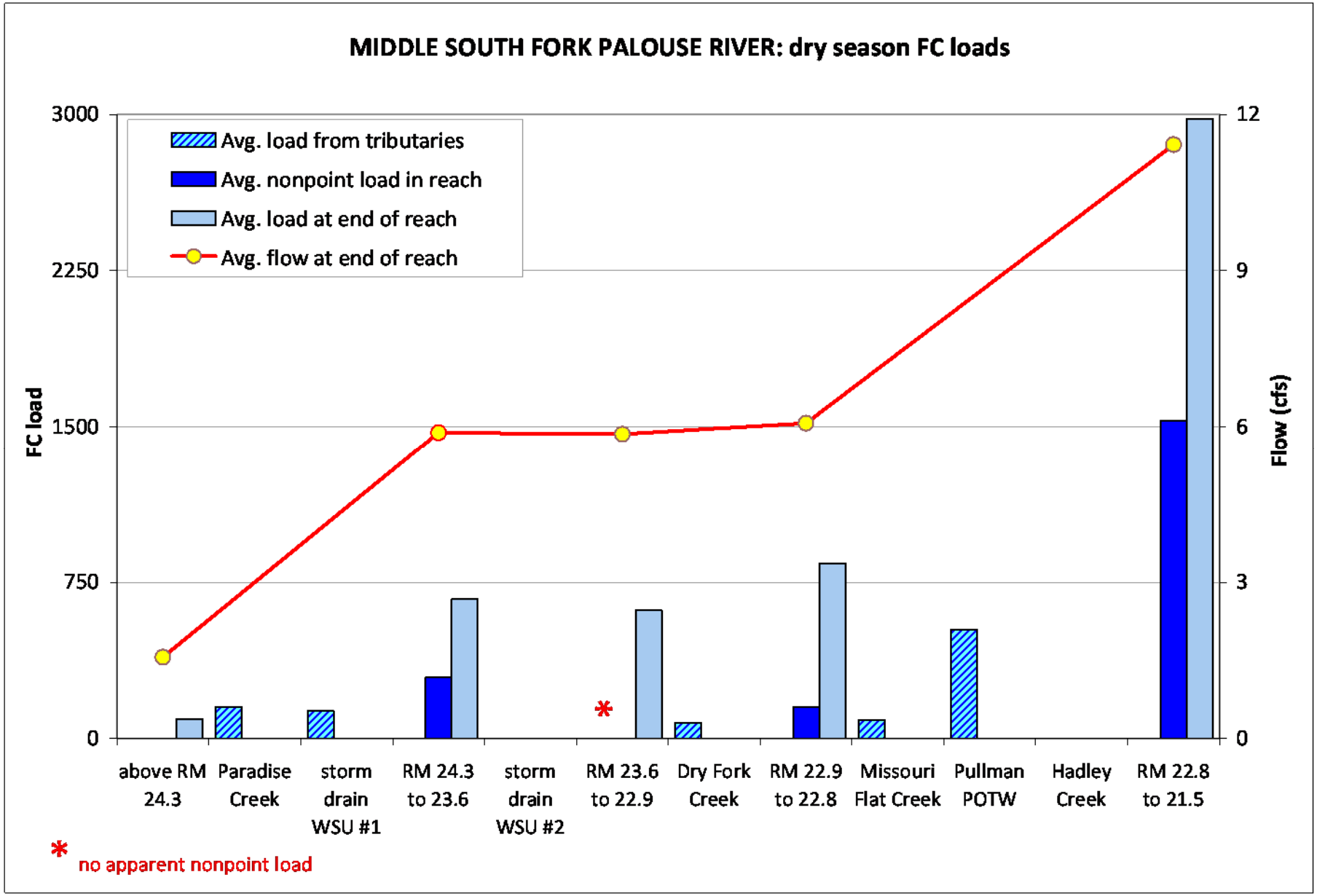
WSU#3
storm drain
Airport
Road Creek
Para00.1
(34C060)
Para01.1

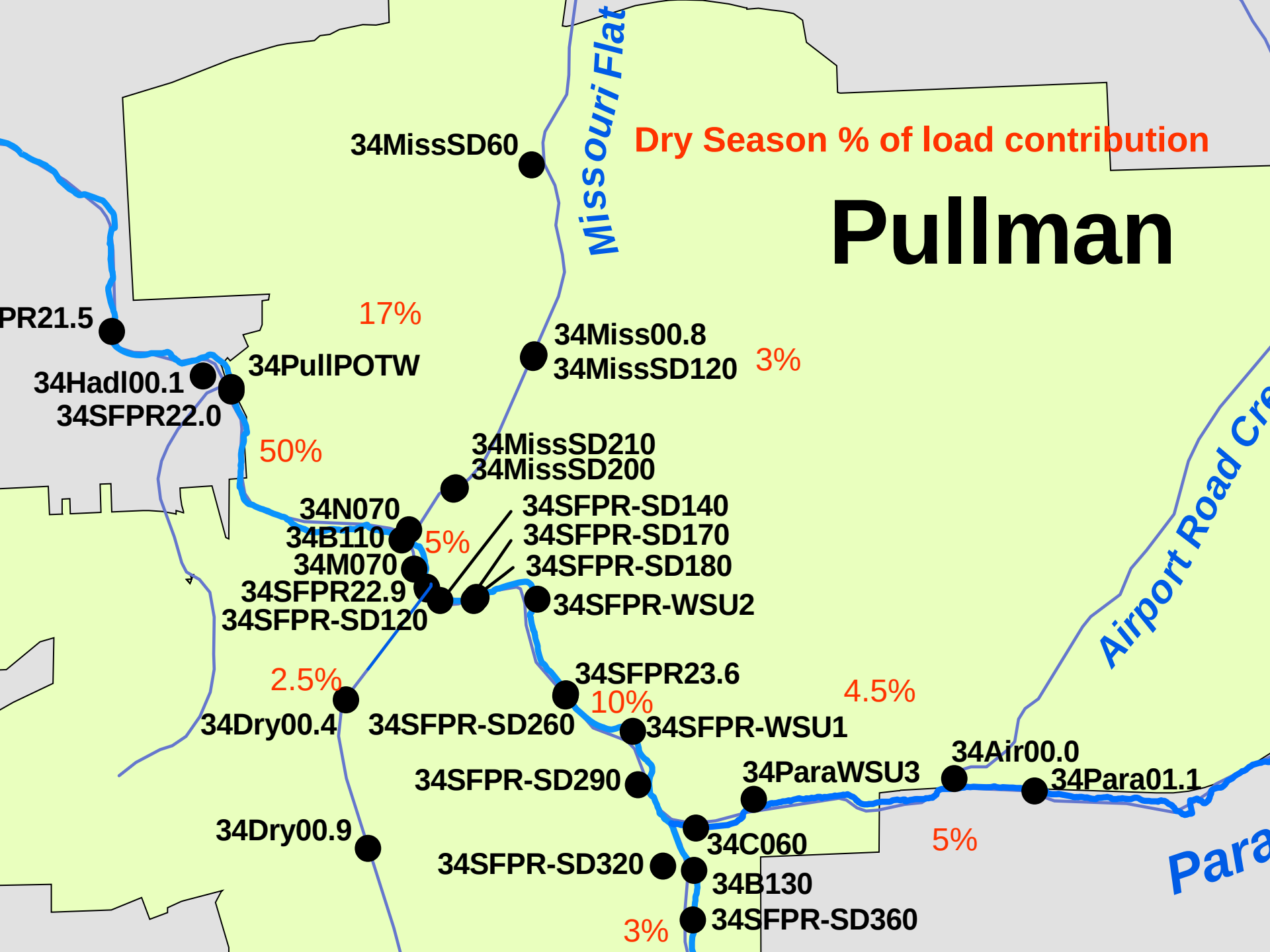

PARADISE CREEK: wet season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
1200
1000
800
600
400
200
0
30
25
20
15
10
5
0
*
*
above RM 8.1
Moscow POTW
Unknown Trib RM 7.5
RM 8.1 to 6.6
RM 6.6 to 3.8
RM 3.8 to 1.1
Airport Ck
RM 3.8 to 0.1
* no apparent nonpoint load

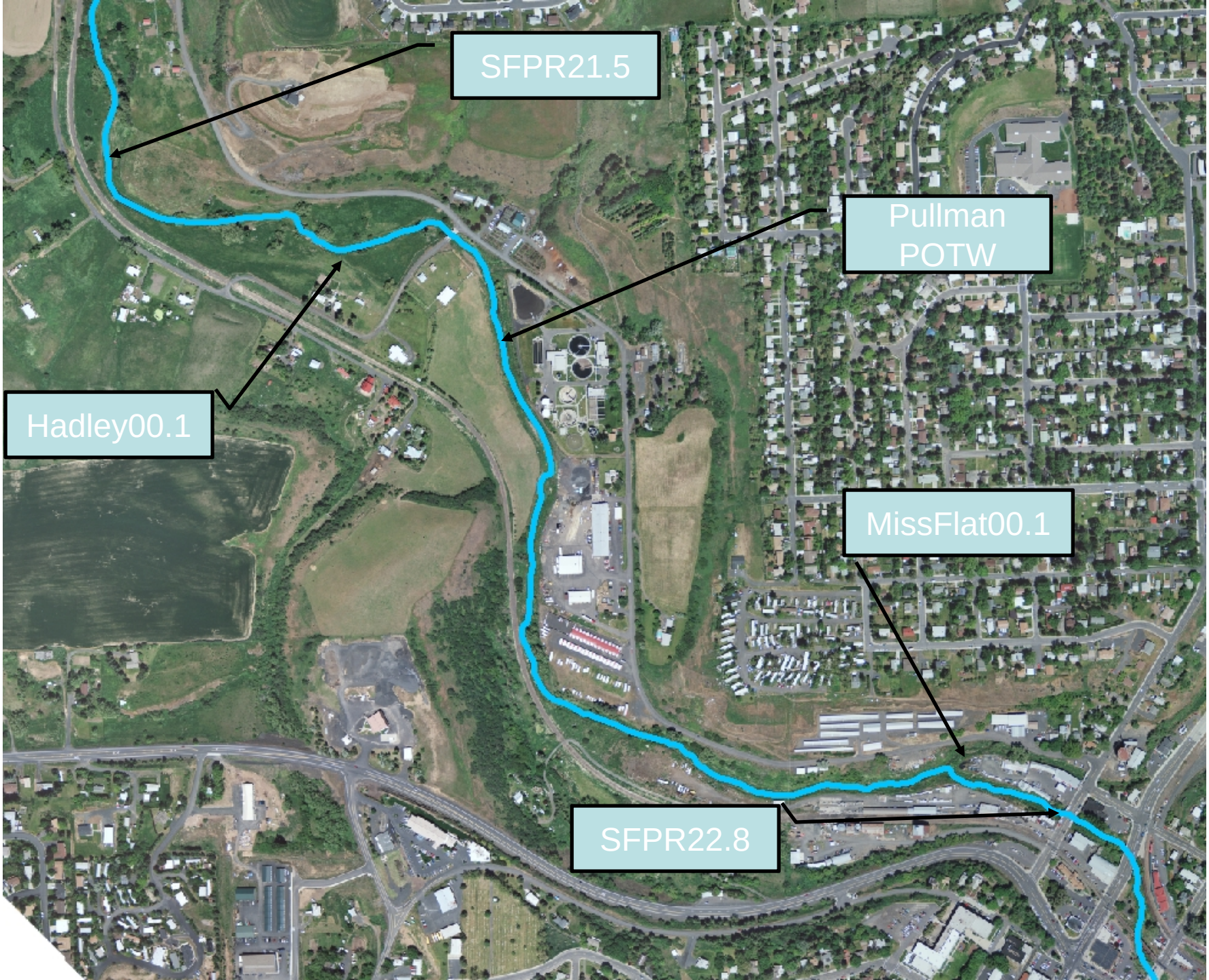
Middle South Fork Palouse River and tributaries								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34SFPR24.3	17	3	6	52	427	2500	24%	**53%**
34Para00.1	14	3	3	32	320	930	14%	**37%**
34SFPR-SD320	10	1	0	7	119	390	20%	**0%**
34SFPR-SD290	0	----	----	----	----	----	----	**----**
34SFPRWSU1	11	1	2	36	709	1000	18%	**72%**
34SFPR23.6	15	16	14	79	448	2300	13%	**55%**
34SFPR-SD260	11	7	9	48	261	410	18%	**23%**
34SFPRWSU2	12	1	1	19	507	2200	17%	**61%**
34SFPR-SD180	2	170	----	345	----	700	50%	84%
34SFPR-SD170	7	3	3	30	281	250	14%	**29%**
34SFPR-SD140	0	----	----	----	----	----	----	**----**
34SFPR22.9	12	15	13	78	472	2300	17%	**58%**
34SFPR-SD120	9	190	153	1695	18752	20000	89%	**99%**
34Dry00.0	12	46	66	380	2199	7500	83%	**91%**
34SFPR22.8	17	11	19	80	330	930	18%	**39%**
34Miss00.1	12	9	13	84	530	2200	25%	**62%**
34SFPR22.0	15	6	12	63	335	840	13%	**40%**
34PullPOTW	12	1	2	9	47	63	0%	**0%**
34HADL00.0	8	29	33	114	396	340	38%	**50%**
34SFPR21.5	13	12	20	103	545	1300	38%	**63%**
	DRY SEASON							
34SFPR24.3	14	2	2.7	30	335	720	21%	**40%**
34Para00.1	12	4	6.1	55	492	1700	17%	**59%**
34SFPR-SD320	3	1	----	3	----	12	----	0%
34SFPR-SD290	1	170	----	170	----	170	----	41%
34SFPRWSU1	11	1	2.5	74	2216	2200	45%	**91%**
34SFPR23.6	12	17	27	178	1186	2600	58%	**83%**
34SFPR-SD260	6	9	9.1	141	2173	4200	50%	**91%**
34SFPRWSU2	11	1	2.8	39	544	700	27%	**63%**
34SFPR-SD180	1	150	----	150	----	150	----	33%
34SFPR-SD170	1	48	----	48	----	48	----	0%
34SFPR-SD140	0	----	----	----	----	----	----	**----**
34SFPR22.9	12	20	24	175	1256	2700	42%	**84%**
34SFPR-SD120	2	27	----	87	----	280	----	72%
34Dry00.0	11	75	118	474	1901	3600	82%	**89%**
34SFPR22.8	18	31	40	236	1386	6250	56%	**86%**
34Miss00.1	11	48	54	237	1034	1200	55%	**81%**
34SFPR22.0	6	27	27	130	624	780	33%	**68%**
34PullPOTW	11	4	4.7	33	236	330	18%	**15%**
34HADL00.0	0	----	----	----	----	----	----	**----**
34SFPR21.5	12	54	54	146	389	480	50%	**49%**

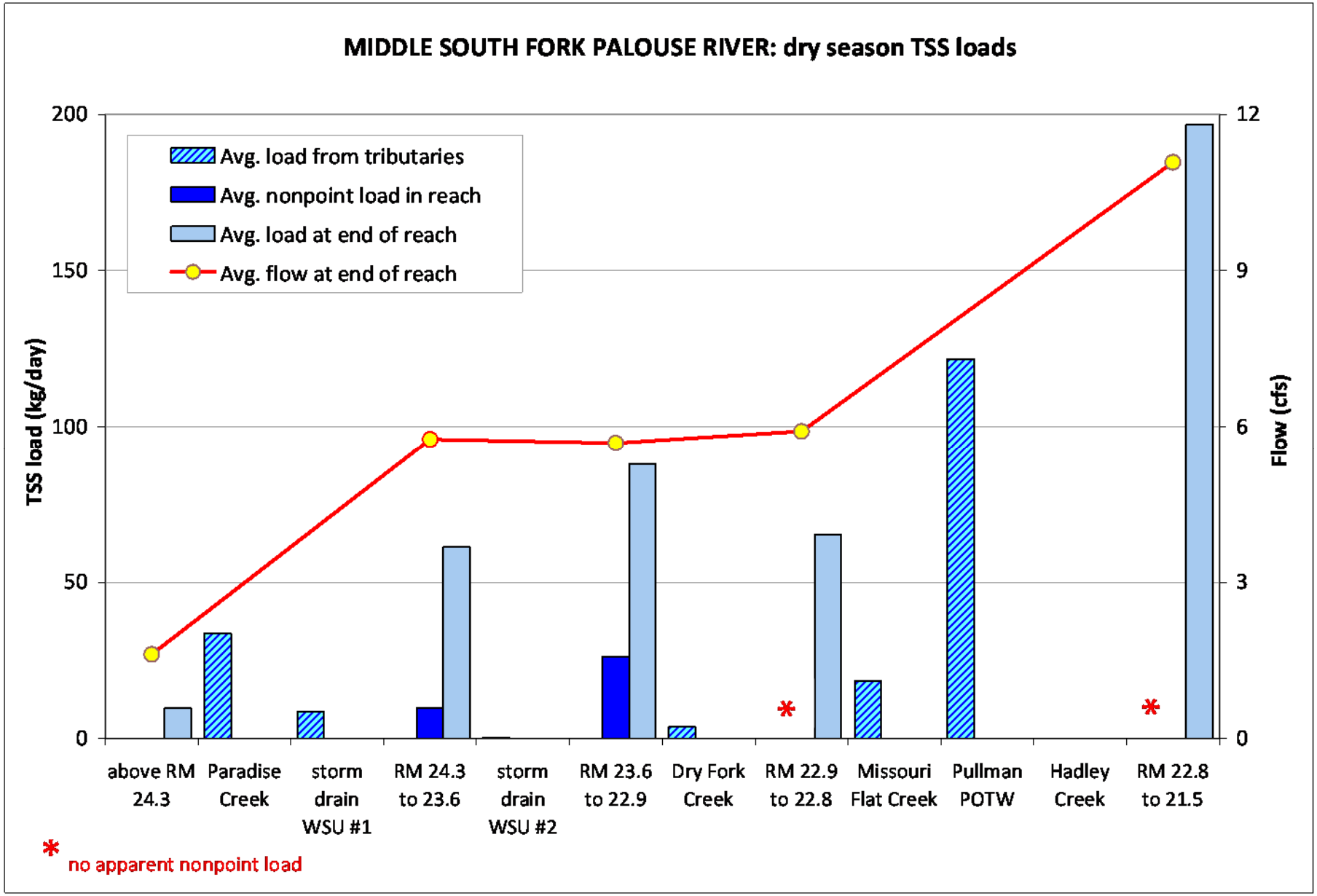
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

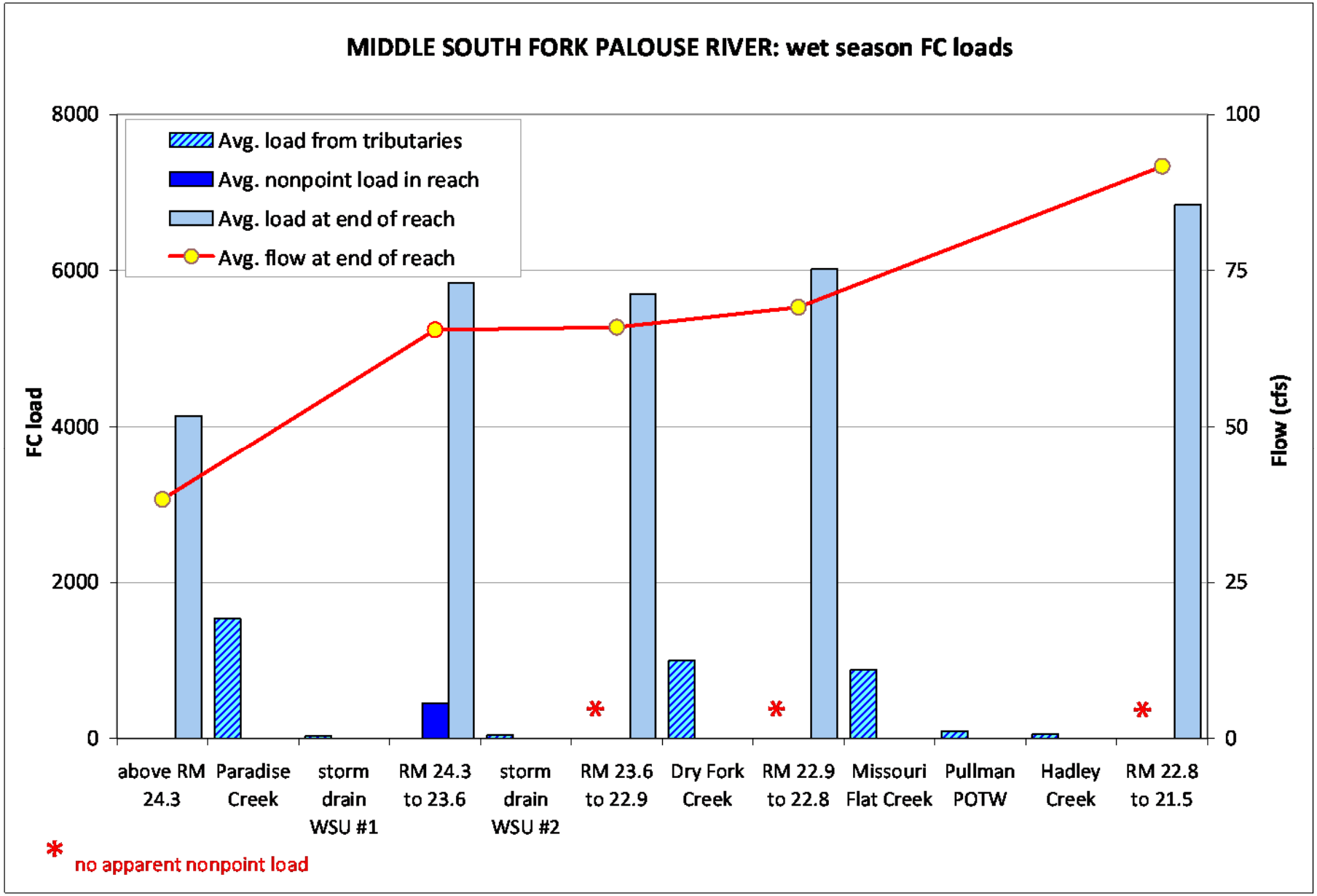

34Miss01.7
Missouri Flat Creek
34MissSD60
Pullman
34SFPR21.5
34Miss00.8
34MissSD120
34PullPOTW
34Hadl00.1
34SFPR22.0
34MissSD210
34MissSD200
34N070
34B110
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
Airport Road
34SFPR23.6
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34Air00.0
34ParaWSU3
34Para01.1
34SFPR-SD290
34Dry00.9
34C060
34SFPR-SD320
34B130

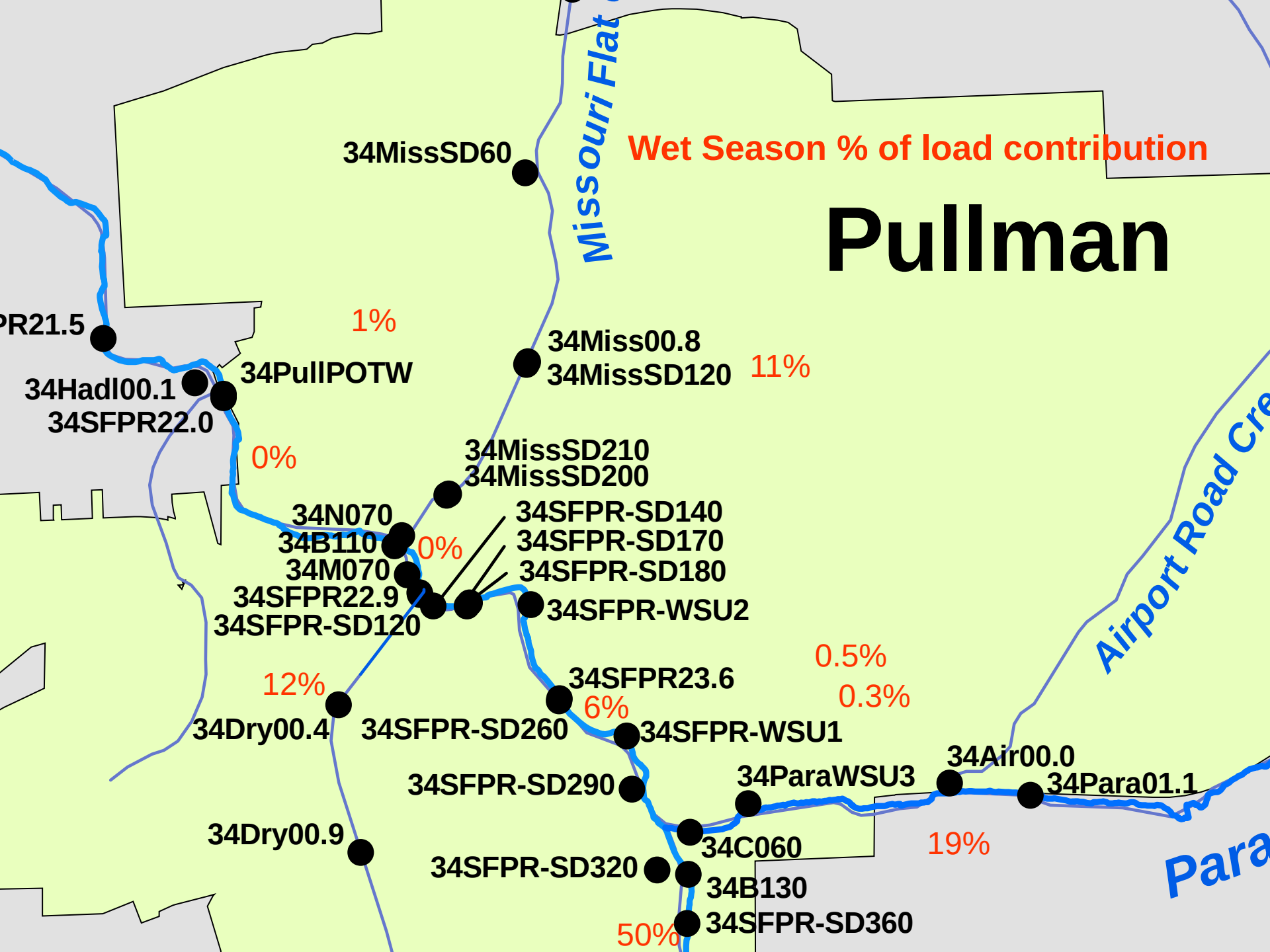

MIDDLE SOUTH FORK PALOUSE RIVER: dry season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
3000
2250
1500
750
0
12
9
6
3
0
above RM 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
*
* no apparent nonpoint load

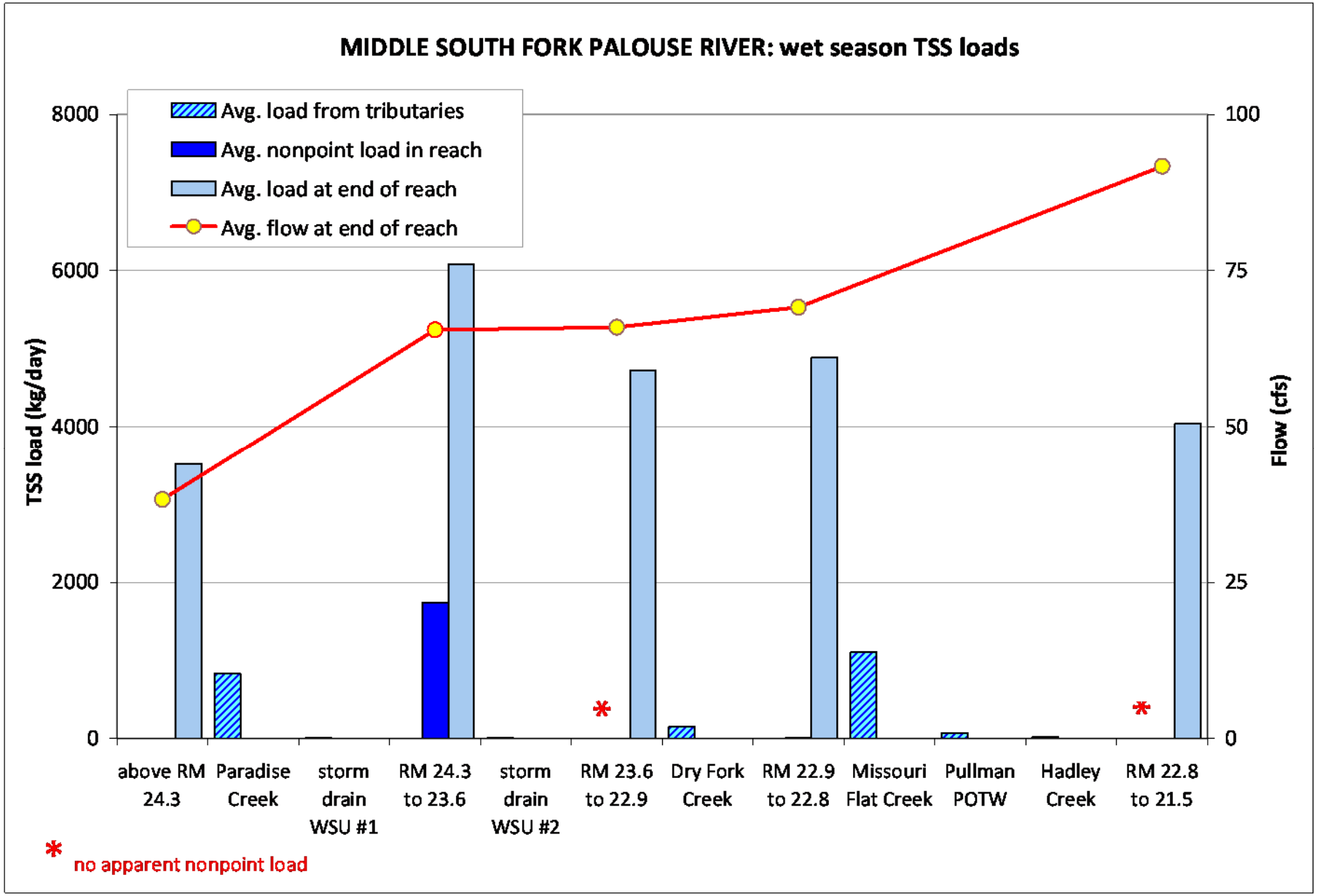

Dry Season % of load contribution
Pullman
Missouri Flat
Airport Road Cre
Para
34MissSD60
PR21.5
17%
34Miss00.8
34MissSD120
3%
34PullPOTW
34Hadl00.1
34SFPR22.0
50%
34MissSD210
34MissSD200
34N070
34B110
5%
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
2.5%
34Dry00.4
34SFPR-SD260
34SFPR23.6
10%
34SFPR-WSU1
4.5%
34SFPR-SD290
34ParaWSU3
34Air00.0
34Para01.1
34Dry00.9
34C060
5%
34SFPR-SD320
34B130
34SFPR-SD360
3%


SFPR21.5
Pullman POTW
Hadley00.1
MissFlat00.1
SFPR22.8


MIDDLE SOUTH FORK PALOUSE RIVER: dry season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
200
150
100
50
0
12
9
6
3
0
above RM 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
*
*
* no apparent nonpoint load

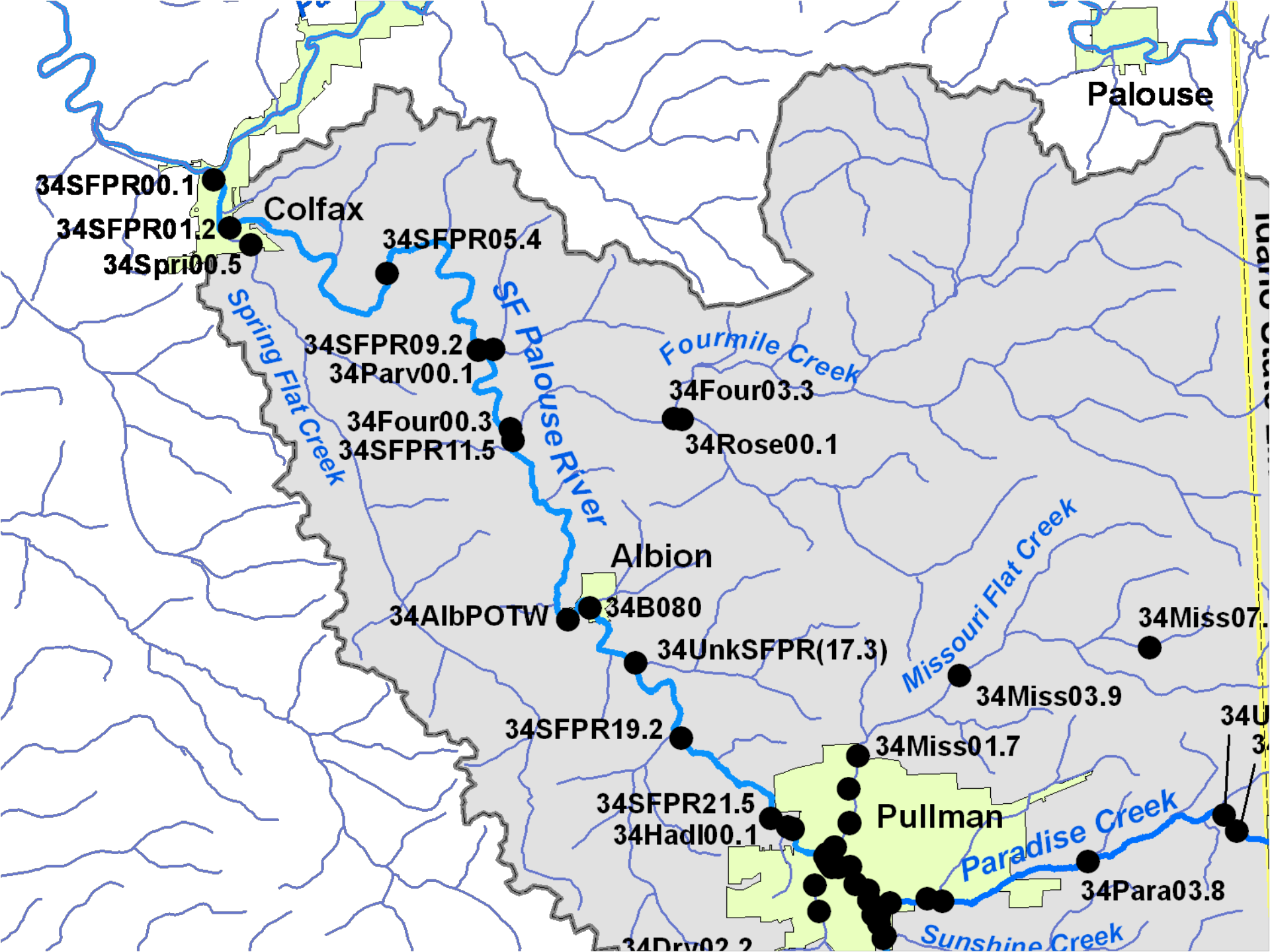

MIDDLE SOUTH FORK PALOUSE RIVER: wet season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
8000
6000
4000
2000
0
100
75
50
25
0
above RM 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
* no apparent nonpoint load

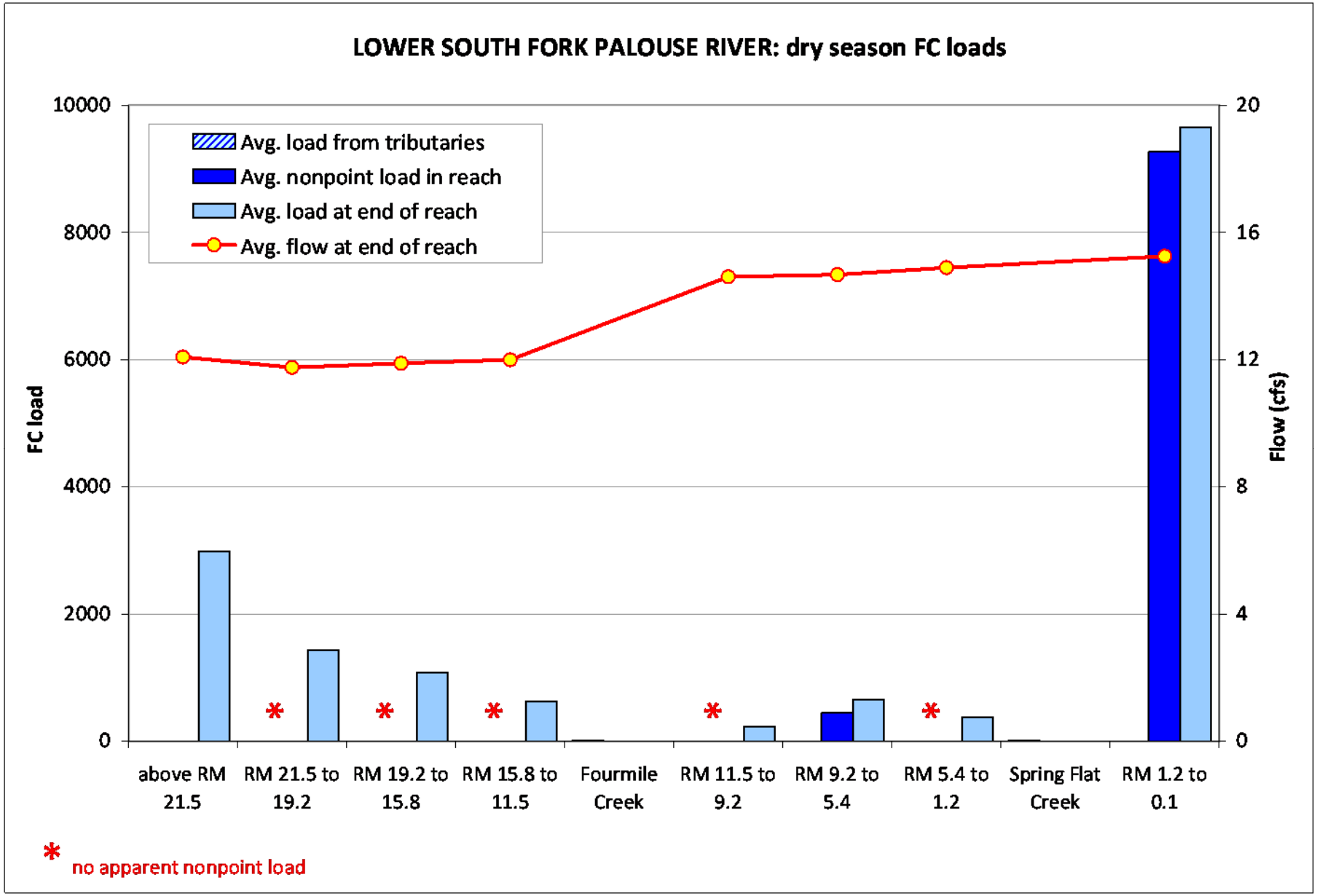

Wet Season % of load contribution
Pullman
Missouri Flat
Airport Road Cre
Para
34MissSD60
PR21.5
1%
34Miss00.8
34MissSD120
11%
34PullPOTW
34Hadl00.1
34SFPR22.0
0%
34MissSD210
34MissSD200
34N070
34B110
0%
34M070
34SFPR22.9
34SFPR-SD120
34SFPR-SD140
34SFPR-SD170
34SFPR-SD180
34SFPR-WSU2
0.5%
0.3%
12%
34SFPR23.6
6%
34Dry00.4
34SFPR-SD260
34SFPR-WSU1
34Air00.0
34ParaWSU3
34Para01.1
34SFPR-SD290
19%
34Dry00.9
34C060
34SFPR-SD320
34B130
34SFPR-SD360
50%


MIDDLE SOUTH FORK PALOUSE RIVER: wet season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
8000
6000
4000
2000
0
100
75
50
25
0
above RM 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
*
*
* no apparent nonpoint load

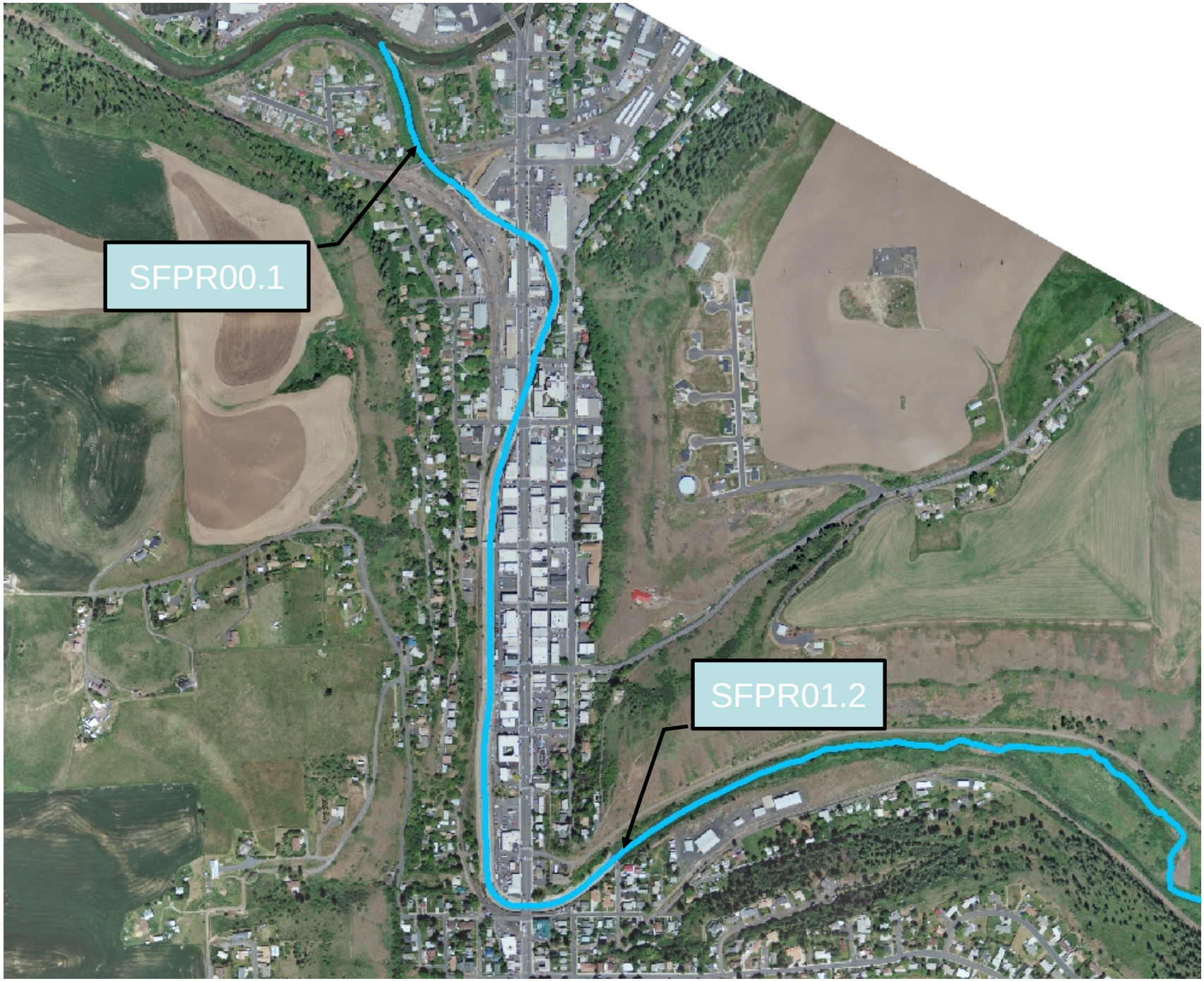
Lower South Fork Palouse River and tributaries								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34SFPR21.5	13	12	20	103	545	1300	38%	**63%**
34SFPR20.1	0	----	----	----	----	----	----	**----**
34SFPR19.2	11	13	9	64	436	3900	9%	**54%**
34UnkSFPR(17.3)	11	1	1	9	65	200	9%	**0%**
34SFPR15.8	12	4	4	34	306	3200	8%	**35%**
34AlbPOTW	4	1	----	2	----	3	0%	0%
34SFPR11.5	11	7	4	50	563	7000	9%	**64%**
34Four00.3	12	2	1	17	209	1400	8%	**4%**
34Parv00.1	11	2	2	9	39	54	0%	**0%**
34SFPR09.2	12	4	3	35	441	9000	8%	**55%**
34SFPR05.4	10	4	4	20	93	260	10%	**0%**
34SFPR01.2	12	3	3	18	120	170	0%	**0%**
34Spri00.5	12	9	5	57	592	2000	25%	**66%**
34SFPR00.1	12	9	6	80	1155	3600	25%	**83%**
	DRY SEASON							
34SFPR21.5	12	54	54	146	389	480	50%	**49%**
34SFPR20.1	1	200	----	200	----	200	----	50%
34SFPR19.2	7	6	11	71	459	460	29%	**56%**
34UnkSFPR(17.3)	3	4	----	11	----	54	----	0%
34SFPR15.8	11	13	20	78	299	345	18%	**33%**
34AlbPOTW	0	----	----	----	----	----	----	**----**
34SFPR11.5	5	4	7.5	54	388	220	20%	**48%**
34Four00.3	6	5	4.1	38	351	430	17%	**43%**
34Parv00.1	3	1	0.8	2	4.9	4	----	0%
34SFPR09.2	11	6	5.5	20	73	100	0%	**0%**
34SFPR05.4	5	11	8.6	40	182	200	20%	**0%**
34SFPR01.2	12	7	5.6	26	121	200	8%	**0%**
34Spri00.5	3	41	32	52	84	80	----	0%
34SFPR00.1	11	19	85	630	4661	2650	82%	**96%**

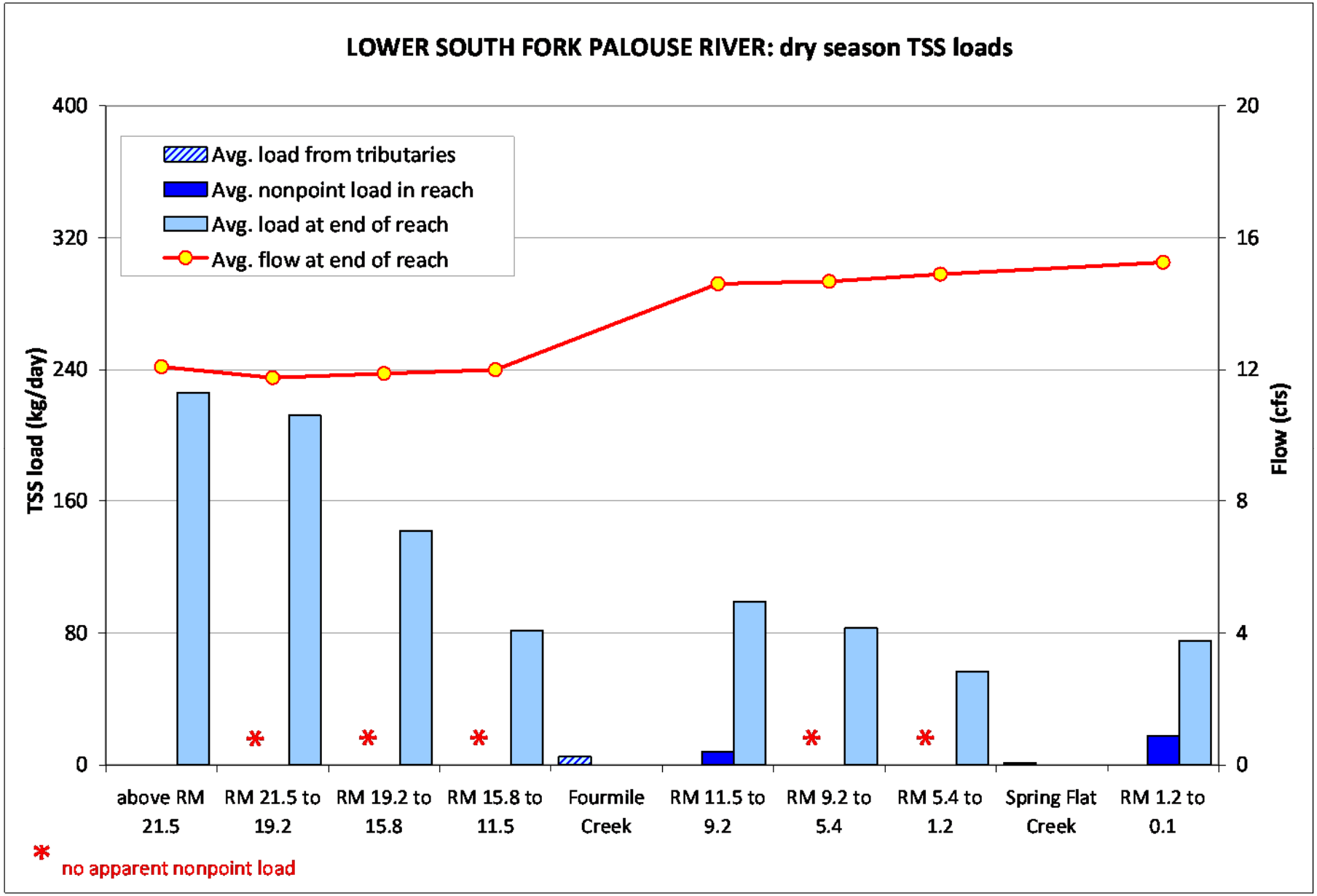
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

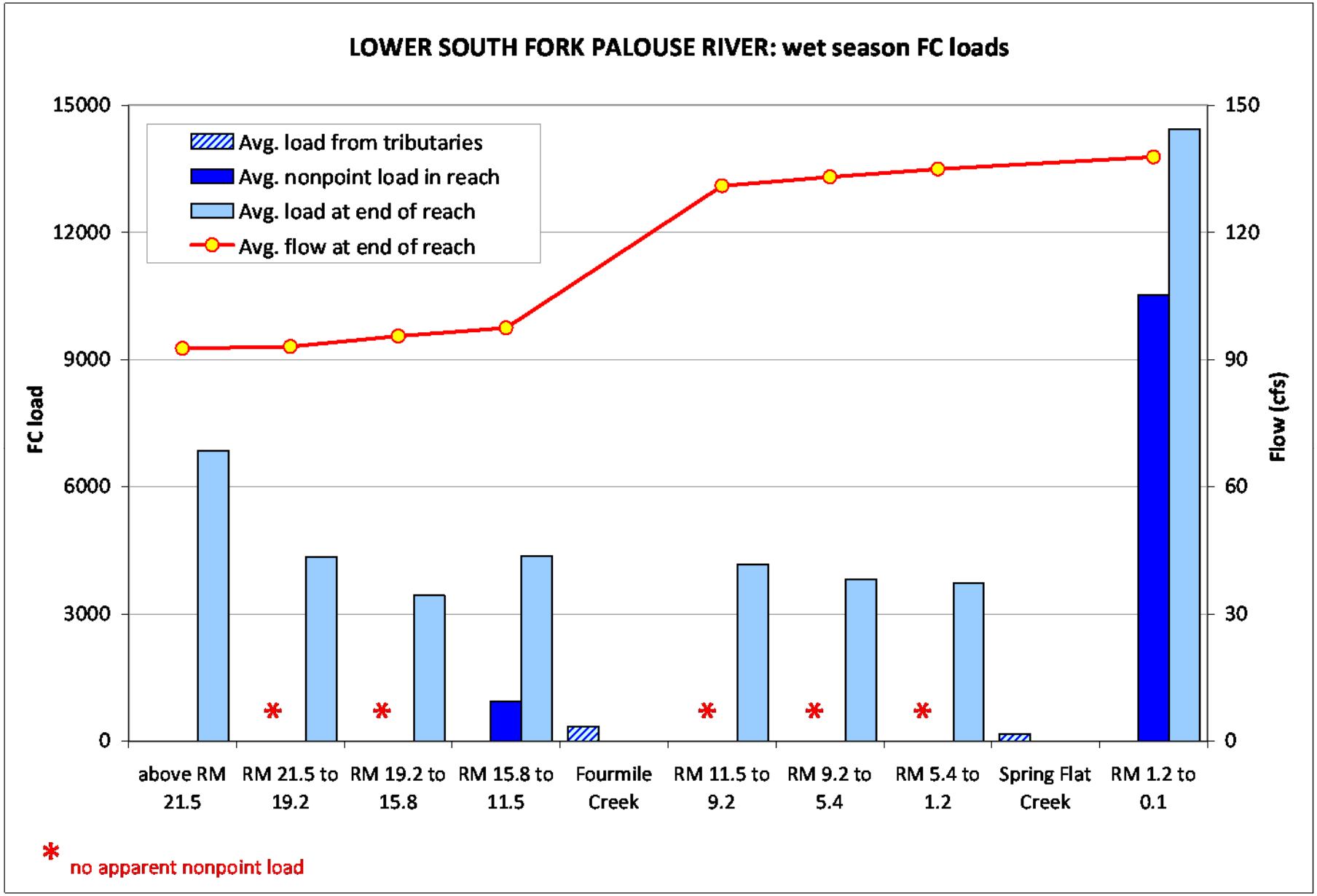

Palouse
34SFPR00.1
Colfax
34SFPR01.2
34Spri00.5
34SFPR05.4
Spring Flat Creek
SF Palouse River
34SFPR09.2
34Parv00.1
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Albion
34AlbPOTW
34B080
34UnkSFPR(17.3)
Missouri Flat Creek
34Miss07.
34Miss03.9
34SFPR19.2
34Miss01.7
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para03.8
Sunshine Creek

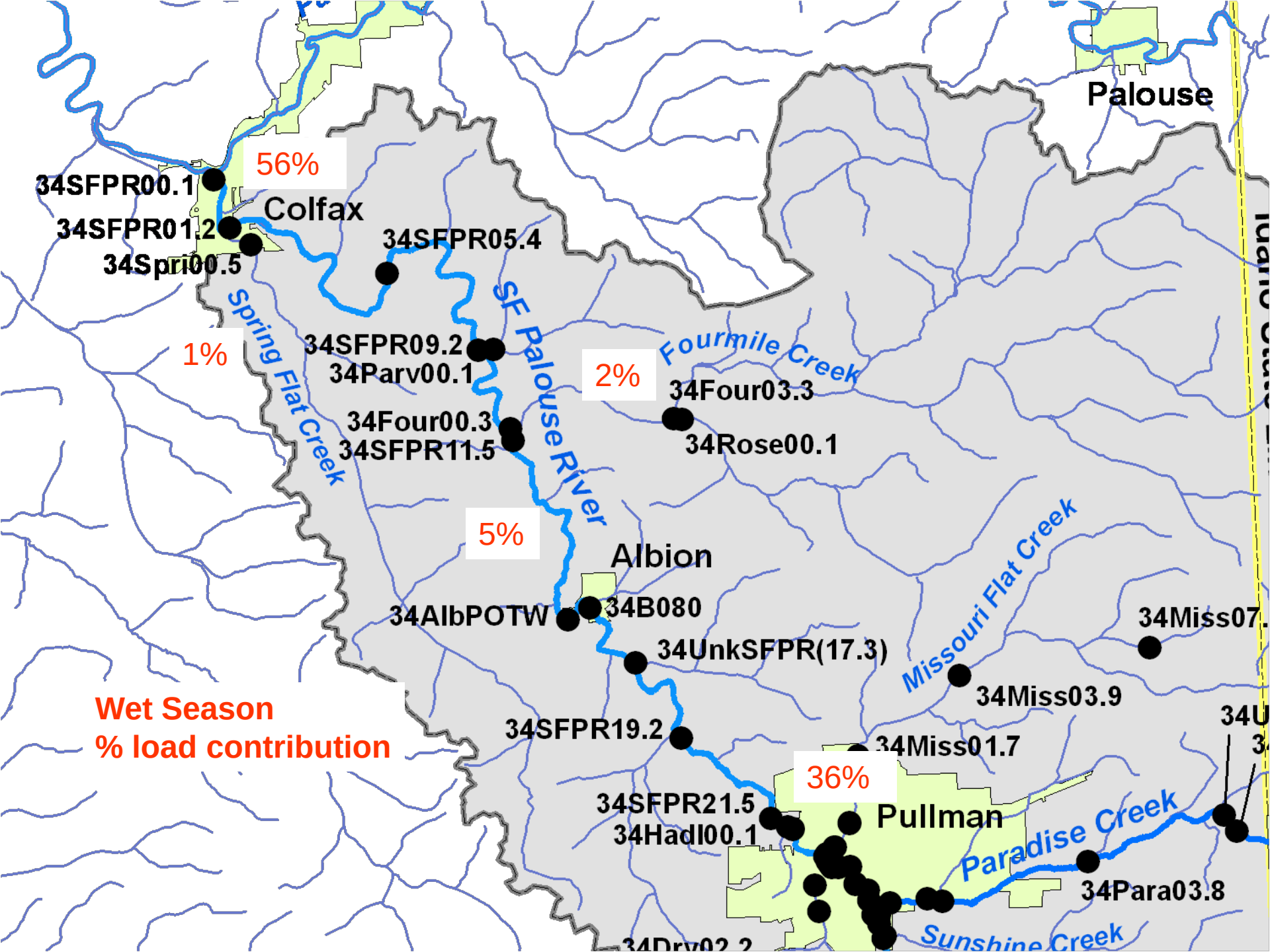

LOWER SOUTH FORK PALOUSE RIVER: dry season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
10000
8000
6000
4000
2000
0
20
16
12
8
4
0
above RM 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1
* no apparent nonpoint load

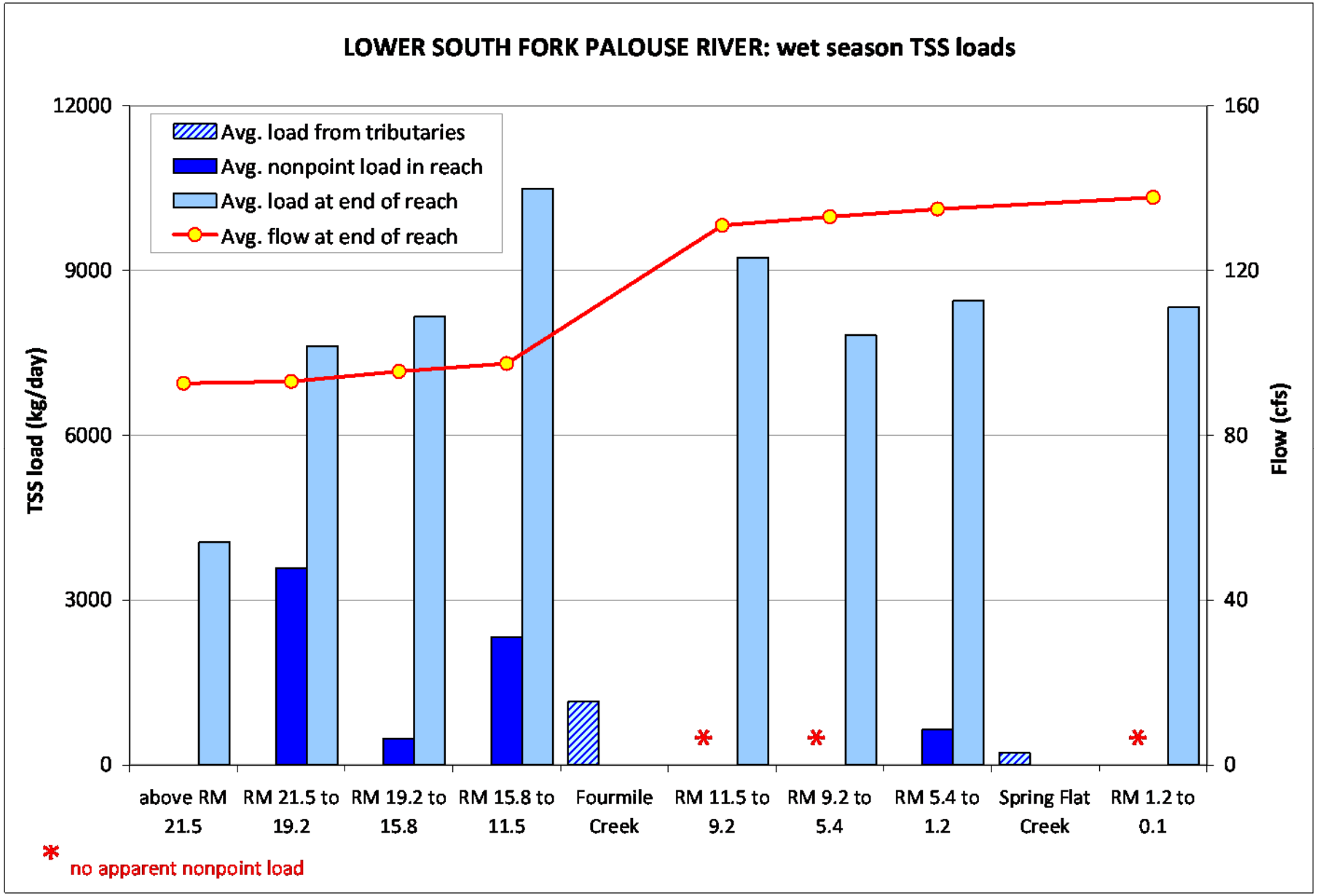
Palouse
74%
34SFPR00.1
Colfax
34SFPR01.2
34Spri00.5
34SFPR05.4
5%
SF Palouse River
Spring Flat Creek
0%
34SFPR09.2
34Parv00.1
0%
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Albion
34AlbPOTW
34B080
34UnkSFPR(17.3)
Missouri Flat Creek
34Miss07.
34Miss03.9
Dry Season
% load contribution
34SFPR19.2
34Miss01.7
23%
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para03.8
Sunshine Creek


SFPR00.1
SFPR01.2


LOWER SOUTH FORK PALOUSE RIVER: dry season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
400
320
240
160
80
0
20
16
12
8
4
0
above RM 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1
* no apparent nonpoint load

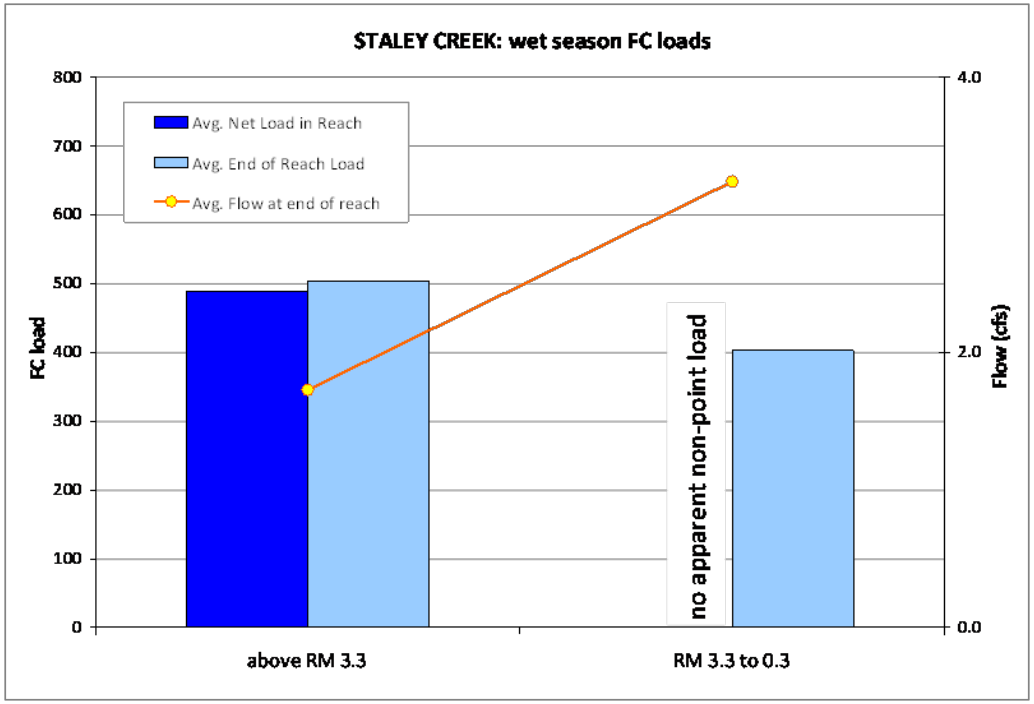

LOWER SOUTH FORK PALOUSE RIVER: wet season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
15000
12000
9000
6000
3000
0
150
120
90
60
30
0
above RM 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1
* no apparent nonpoint load

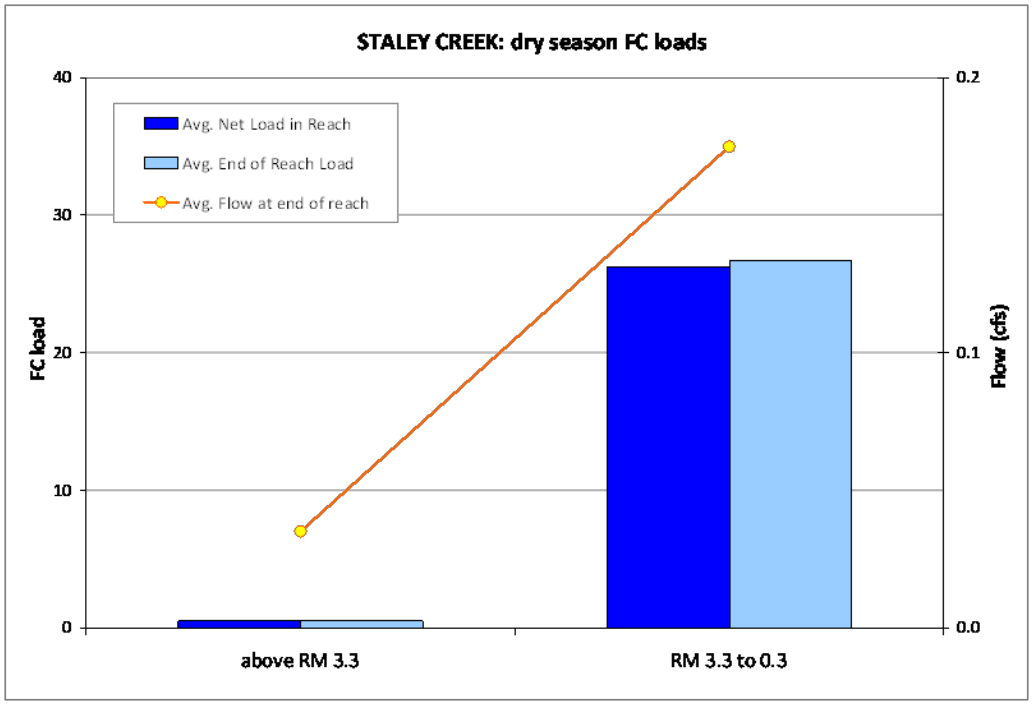

Palouse
56%
34SFPR00.1
Colfax
34SFPR01.2
34Spri00.5
34SFPR05.4
SF Palouse River
Spring Flat Creek
1%
34SFPR09.2
34Parv00.1
2%
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
5%
Albion
34AlbPOTW
34B080
34UnkSFPR(17.3)
Missouri Flat Creek
34Miss07.
34Miss03.9
Wet Season
% load contribution
34SFPR19.2
34Miss01.7
36%
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para03.8
Sunshine Creek

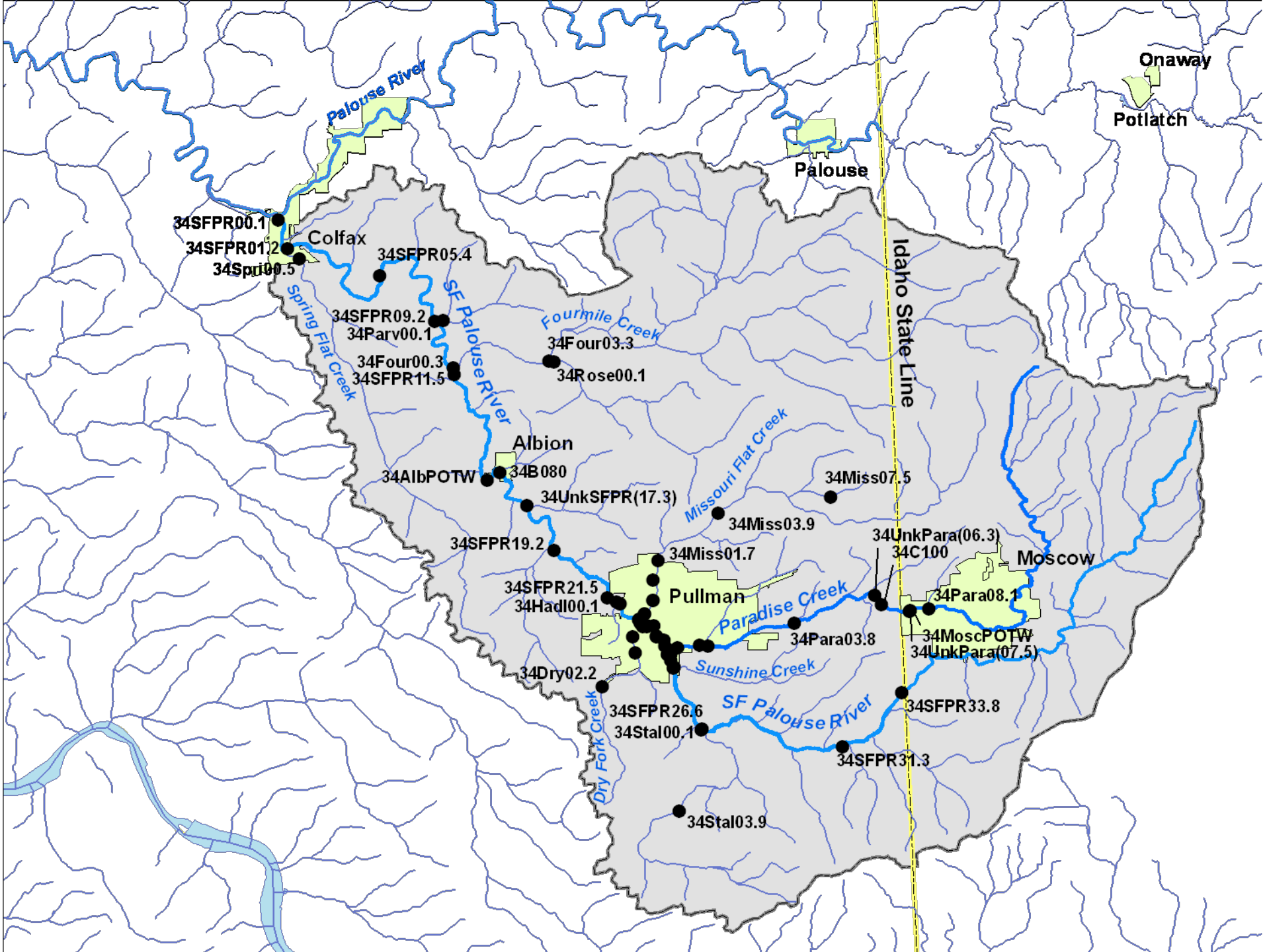

LOWER SOUTH FORK PALOUSE RIVER: wet season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
12000
9000
6000
3000
0
160
120
80
40
0
above RM 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1
* no apparent nonpoint load

Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	TARGET % REDUCTION*
Staley Creek								
	WET SEASON							
34Stal03.9	10	1	2.1	34	549	800	30%	**64%**
34Stal00.1	10	20	15	149	1487	11000	40%	**87%**
	DRY SEASON							
34Stal03.9	5	1	0.6	12	231	200	20%	**14%**
34Stal00.1	8	9	9.4	98	1020	2000	25%	**80%**

*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

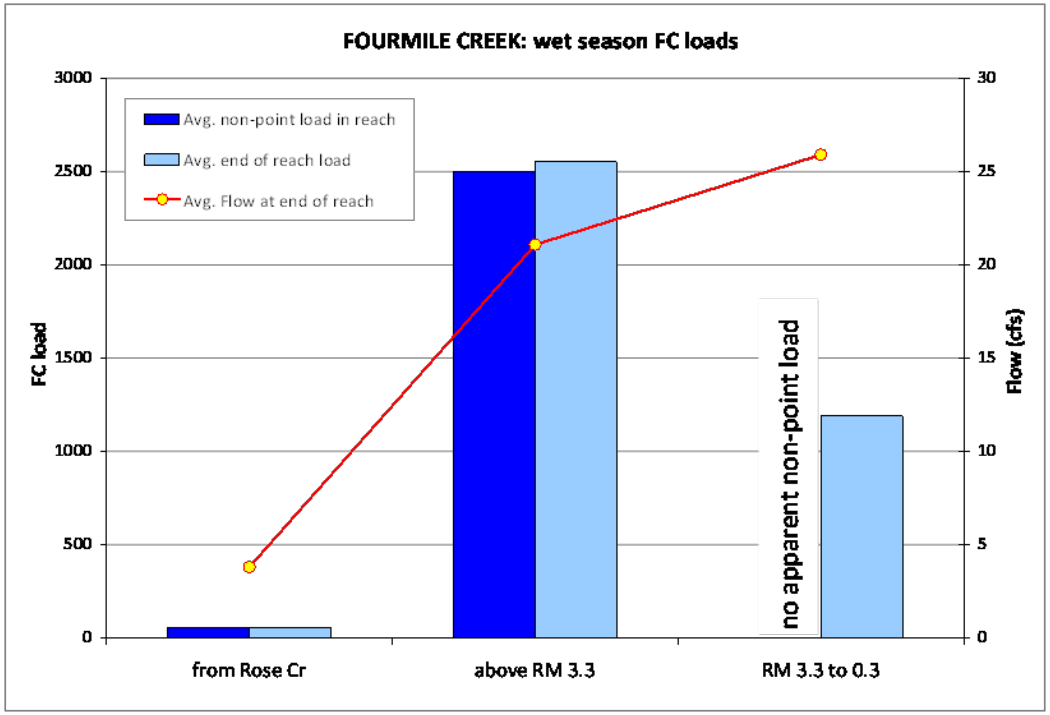

STALEY CREEK: wet season FC loads
Avg. Net Load in Reach
Avg. End of Reach Load
Avg. Flow at end of reach
FC load
Flow (cfs)
800
700
600
500
400
300
200
100
0
4.0
2.0
0.0
no apparent non-point load
above RM 3.3
RM 3.3 to 0.3

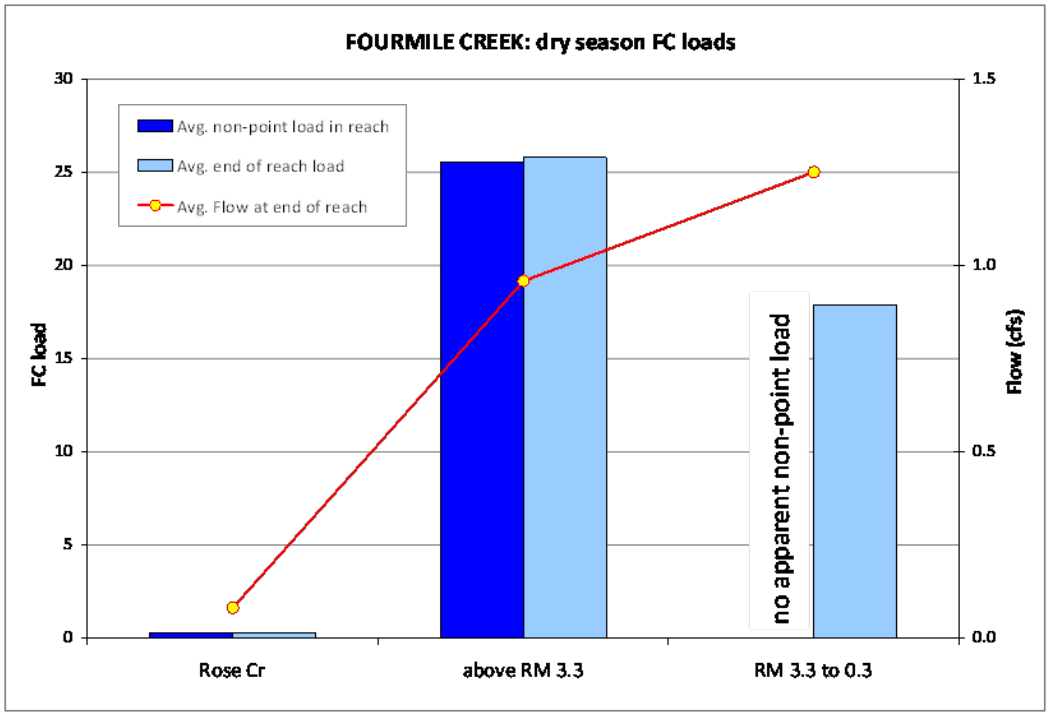

STALEY CREEK: dry season FC loads
Avg. Net Load in Reach
Avg. End of Reach Load
Avg. Flow at end of reach
FC load
Flow (cfs)
40
30
20
10
0
0.2
0.1
0.0
above RM 3.3
RM 3.3 to 0.3

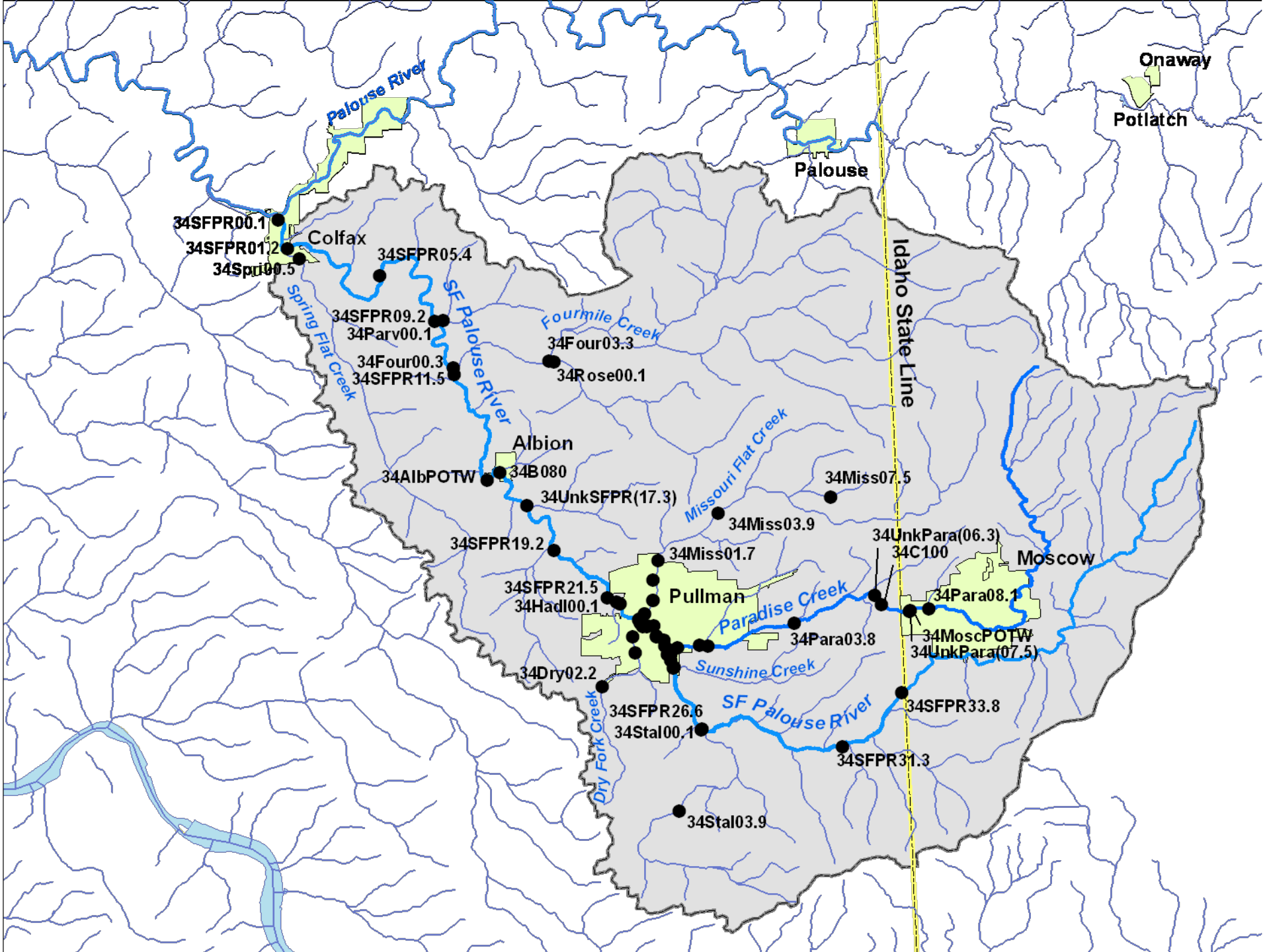

Palouse River
Onaway
Potlatch
Palouse
Colfax
34SFPR00.1
34SFPR01.2
34Spri00.5
34SFPR05.4
Spring Flat Creek
SF Palouse River
34SFPR09.2
34Parv00.1
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Idaho State Line
Albion
34AlbPOTW
34B080
Missouri Flat Creek
34Miss07.5
34UnkSFPR(17.3)
34Miss03.9
34SFPR19.2
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
Sunshine Creek
34Dry02.2
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
Dry Fork Creek
34SFPR31.3
34Stal03.9

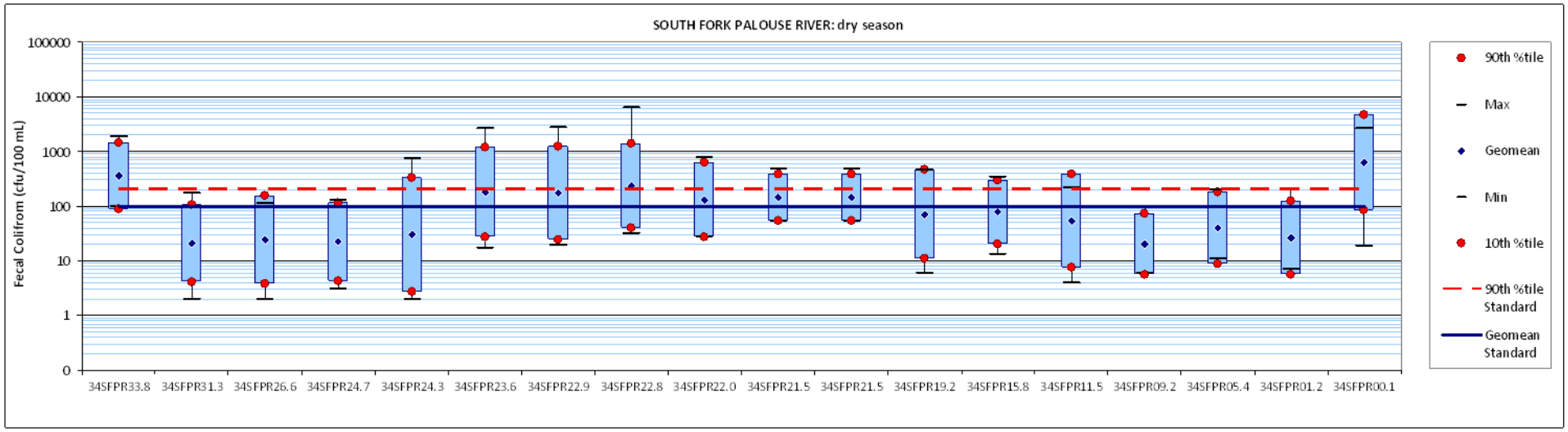
Fourmile Creek								
Station ID	Total # of Samples	Min	10th %tile	Geomean	90th %tile	Max	% Samples > 200 cfu/100 mL	**TARGET % REDUCTION***
	WET SEASON							
34Rose00.1	10	2	2.2	12	62	95	0%	**0%**
34Four03.3	11	4	1.6	30	592	2100	18%	**66%**
34Four00.3	12	2	1.4	17	209	1400	8%	**4%**
	DRY SEASON							
34Rose00.1	1	3	----	----	----	3	----	**0%**
34Four03.3	4	11	----	101	----	2400	25%	**91%**
34Four00.3	6	5	4.1	38	351	430	17%	**43%**

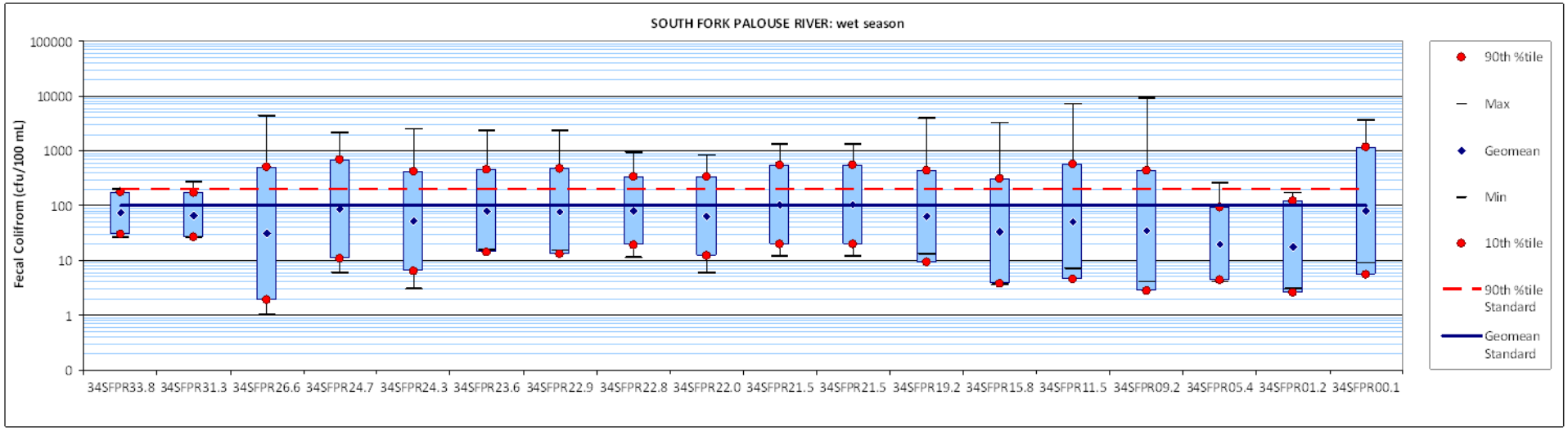
*target percent reduction values that are grayed out are based on less than 5 samples collected at that station for the whole season

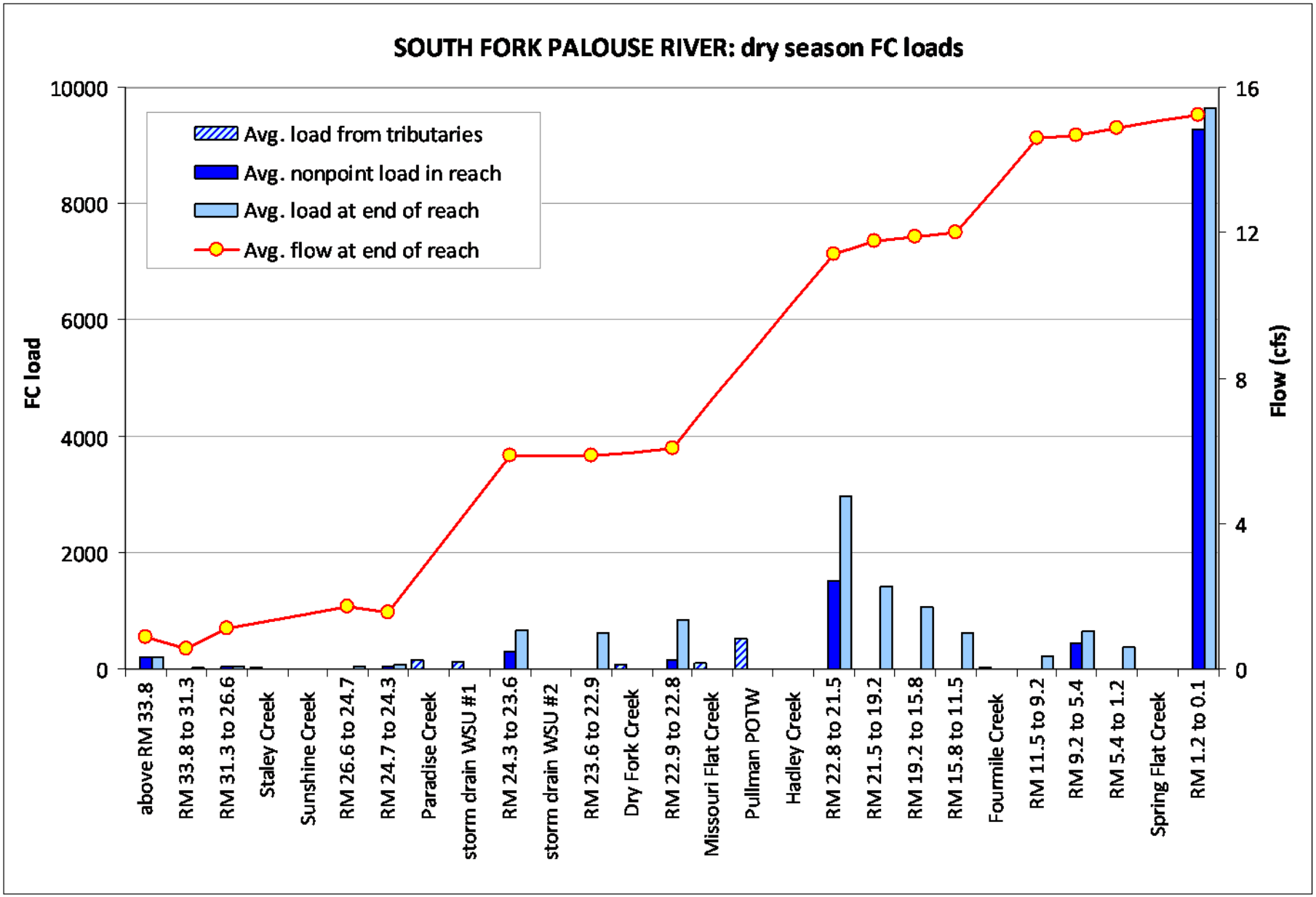

FOURMILE CREEK: wet season FC loads
Avg. non-point load in reach
Avg. end of reach load
Avg. Flow at end of reach
FC load
Flow (cfs)
3000
2500
2000
1500
1000
500
0
30
25
20
15
10
5
0
no apparent non-point load
from Rose Cr
above RM 3.3
RM 3.3 to 0.3


FOURMILE CREEK: dry season FC loads
Avg. non-point load in reach
Avg. end of reach load
Avg. Flow at end of reach
FC load
Flow (cfs)
30
25
20
15
10
5
0
1.5
1.0
0.5
0.0
no apparent non-point load
Rose Cr
above RM 3.3
RM 3.3 to 0.3

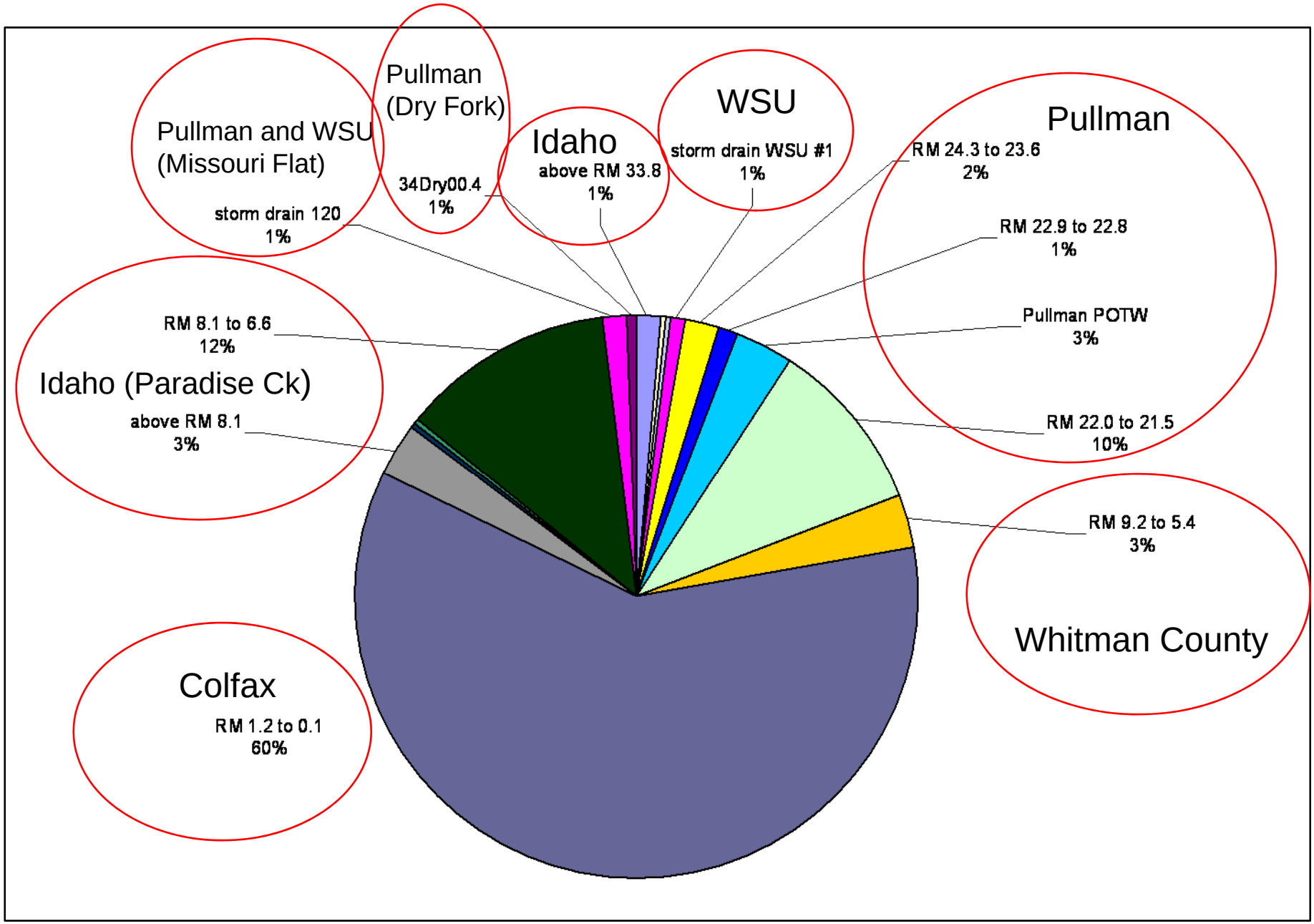

Palouse River
Onaway
Potlatch
Palouse
Colfax
34SFPR00.1
34SFPR01.2
34Spri00.5
34SFPR05.4
Spring Flat Creek
SF Palouse River
34SFPR09.2
34Parv00.1
Fourmile Creek
34Four03.3
34Four00.3
34SFPR11.5
34Rose00.1
Idaho State Line
Albion
34AlbPOTW
34B080
Missouri Flat Creek
34Miss07.5
34UnkSFPR(17.3)
34Miss03.9
34SFPR19.2
34Miss01.7
34UnkPara(06.3)
34C100
Moscow
34SFPR21.5
34Hadl00.1
Pullman
Paradise Creek
34Para08.1
34Para03.8
34MoscPOTW
34UnkPara(07.5)
Sunshine Creek
34Dry02.2
SF Palouse River
34SFPR33.8
34SFPR26.6
34Stal00.1
Dry Fork Creek
34SFPR31.3
34Stal03.9

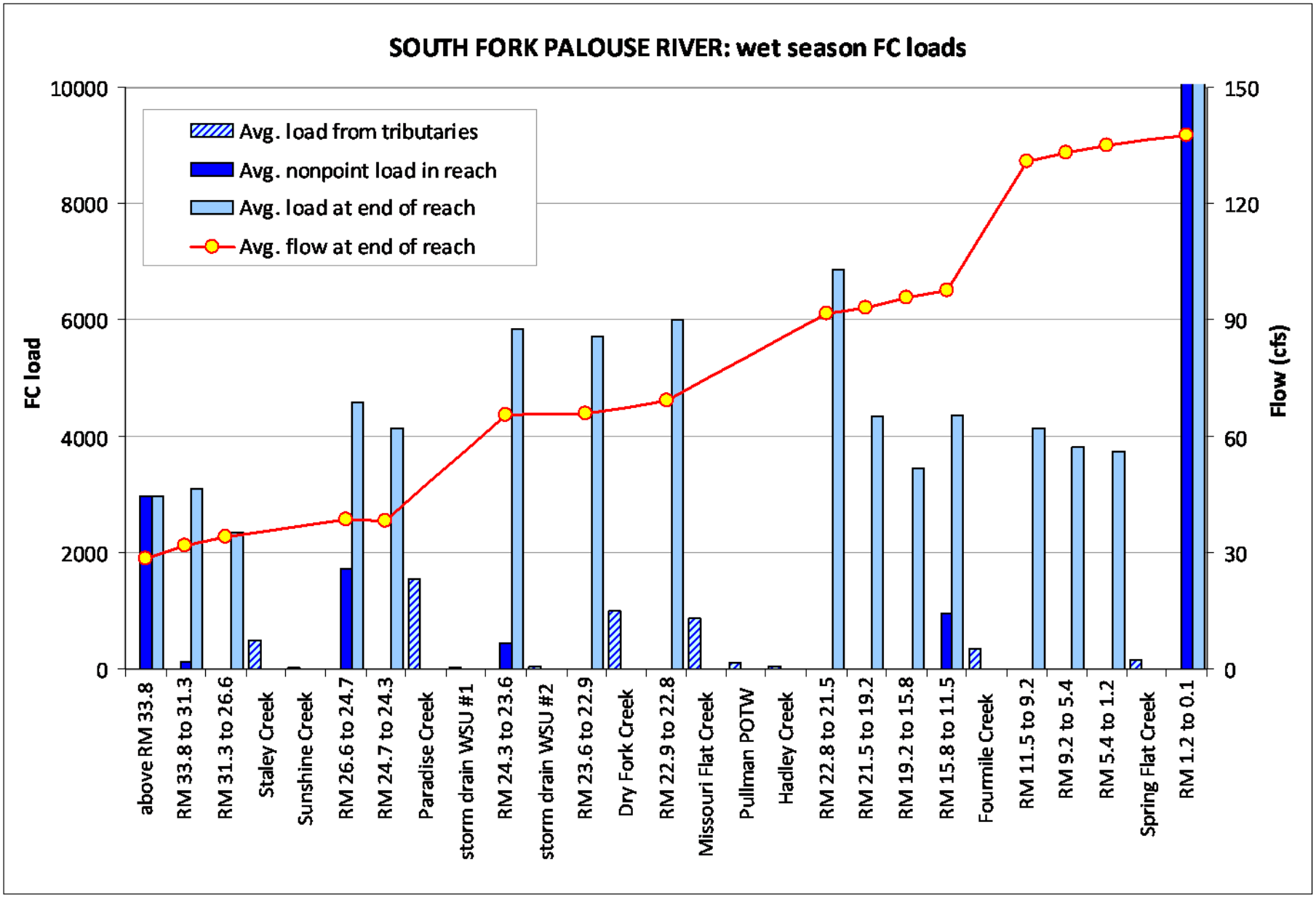

SOUTH FORK PALOUSE RIVER: dry season
Fecal Colifrom (cfu/100 mL)
100000
10000
1000
100
10
1
0
34SFPR33.8
34SFPR31.3
34SFPR26.6
34SFPR24.7
34SFPR24.3
34SFPR23.6
34SFPR22.9
34SFPR22.8
34SFPR22.0
34SFPR21.5
34SFPR21.5
34SFPR19.2
34SFPR15.8
34SFPR11.5
34SFPR09.2
34SFPR05.4
34SFPR01.2
34SFPR00.1
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard


SOUTH FORK PALOUSE RIVER: wet season
Fecal Colifrom (cfu/100 mL)
100000
10000
1000
100
10
1
0
34SFPR33.8
34SFPR31.3
34SFPR26.6
34SFPR24.7
34SFPR24.3
34SFPR23.6
34SFPR22.9
34SFPR22.8
34SFPR22.0
34SFPR21.5
34SFPR21.5
34SFPR19.2
34SFPR15.8
34SFPR11.5
34SFPR09.2
34SFPR05.4
34SFPR01.2
34SFPR00.1
90th %tile
Max
Geomean
Min
10th %tile
90th %tile Standard
Geomean Standard

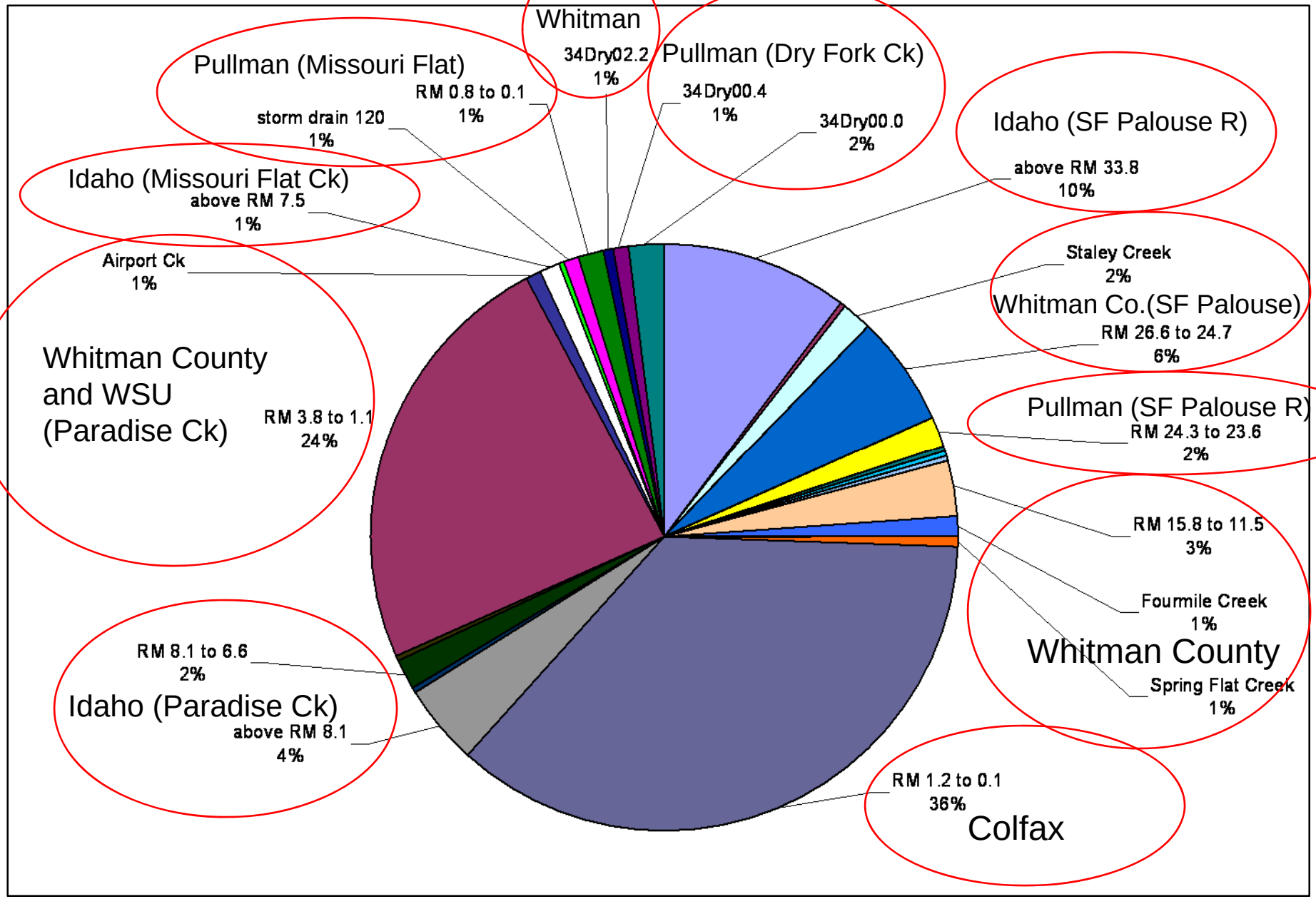

SOUTH FORK PALOUSE RIVER: dry season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
10000
8000
6000
4000
2000
0
16
12
8
4
0
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1

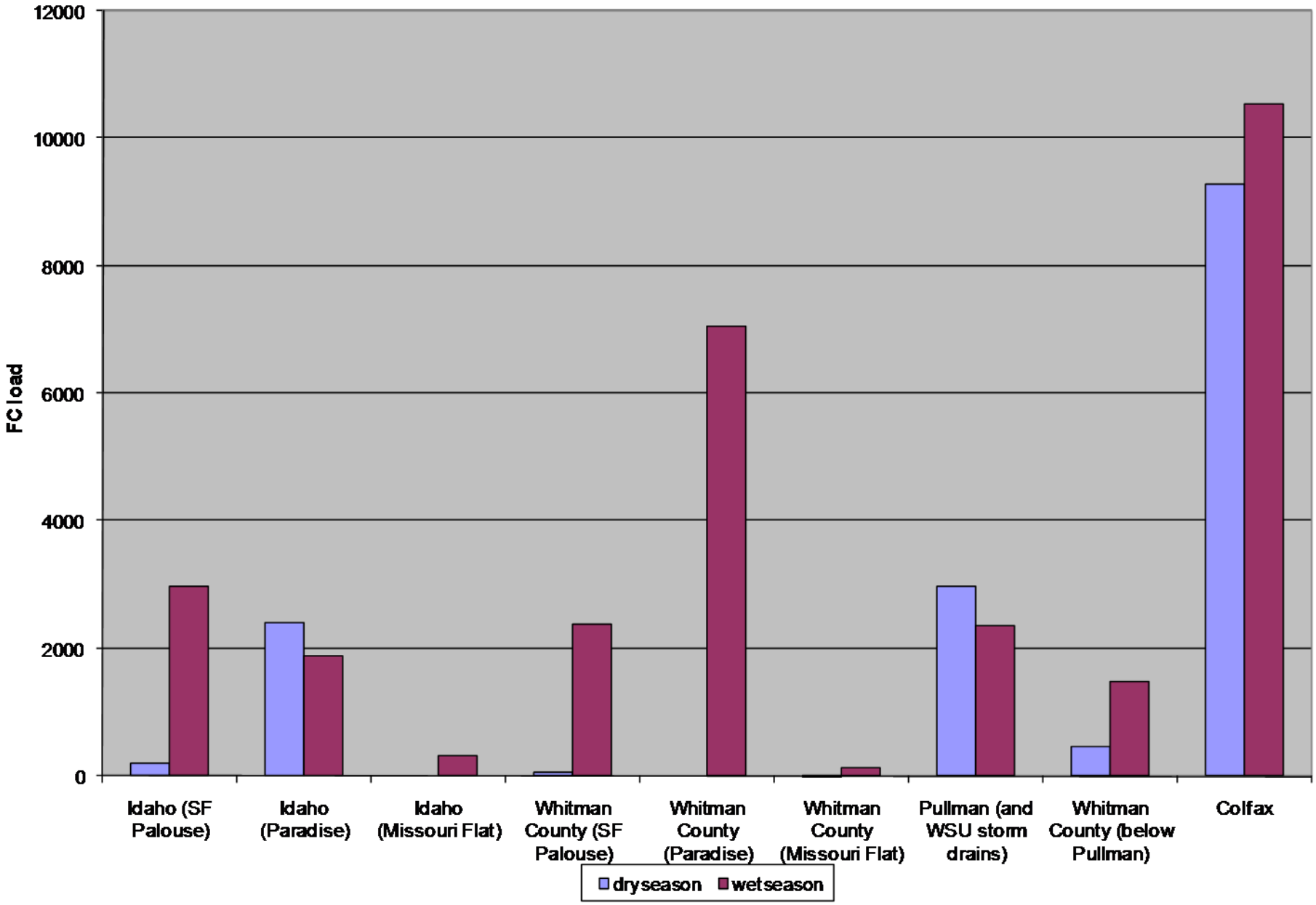
Dry season FC loadings




SOUTH FORK PALOUSE RIVER: wet season FC loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
FC load
Flow (cfs)
10000
8000
6000
4000
2000
0
150
120
90
60
30
0
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1

Wet season FC loadings




12000
10000
8000
6000
4000
2000
0
FC load
Idaho (SF Palouse)
Idaho (Paradise)
Idaho (Missouri Flat)
Whitman County (SF Palouse)
Whitman County (Paradise)
Whitman County (Missouri Flat)
Pullman (and WSU storm drains)
Whitman County (below Pullman)
Colfax
dryseason
wetseason

On average, the increase in load in Colfax city limits equals about 245 billion FC bacteria per day.

- Humans generate 2 billion FC bacteria per day for one human:

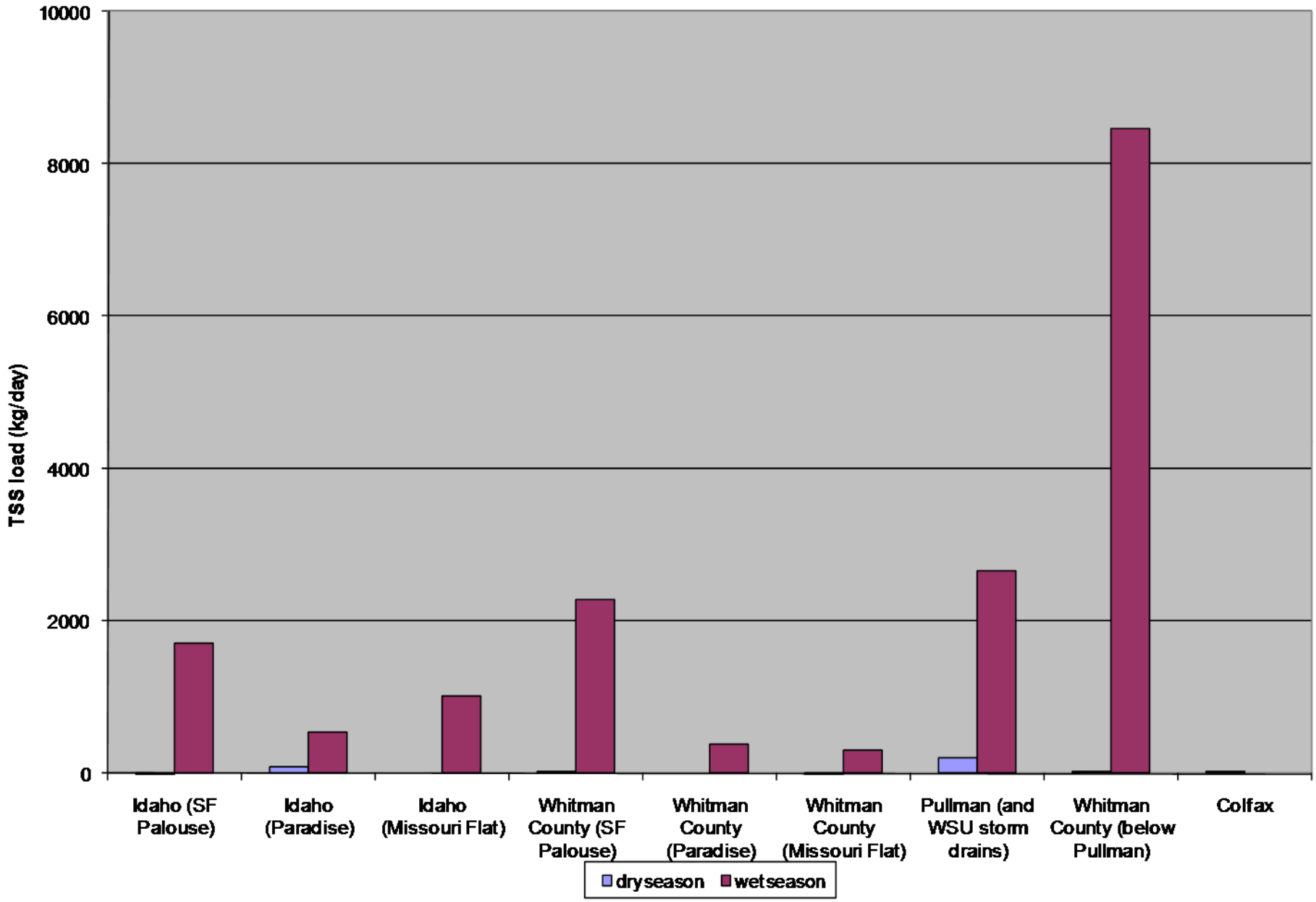
  ≈ 122 people

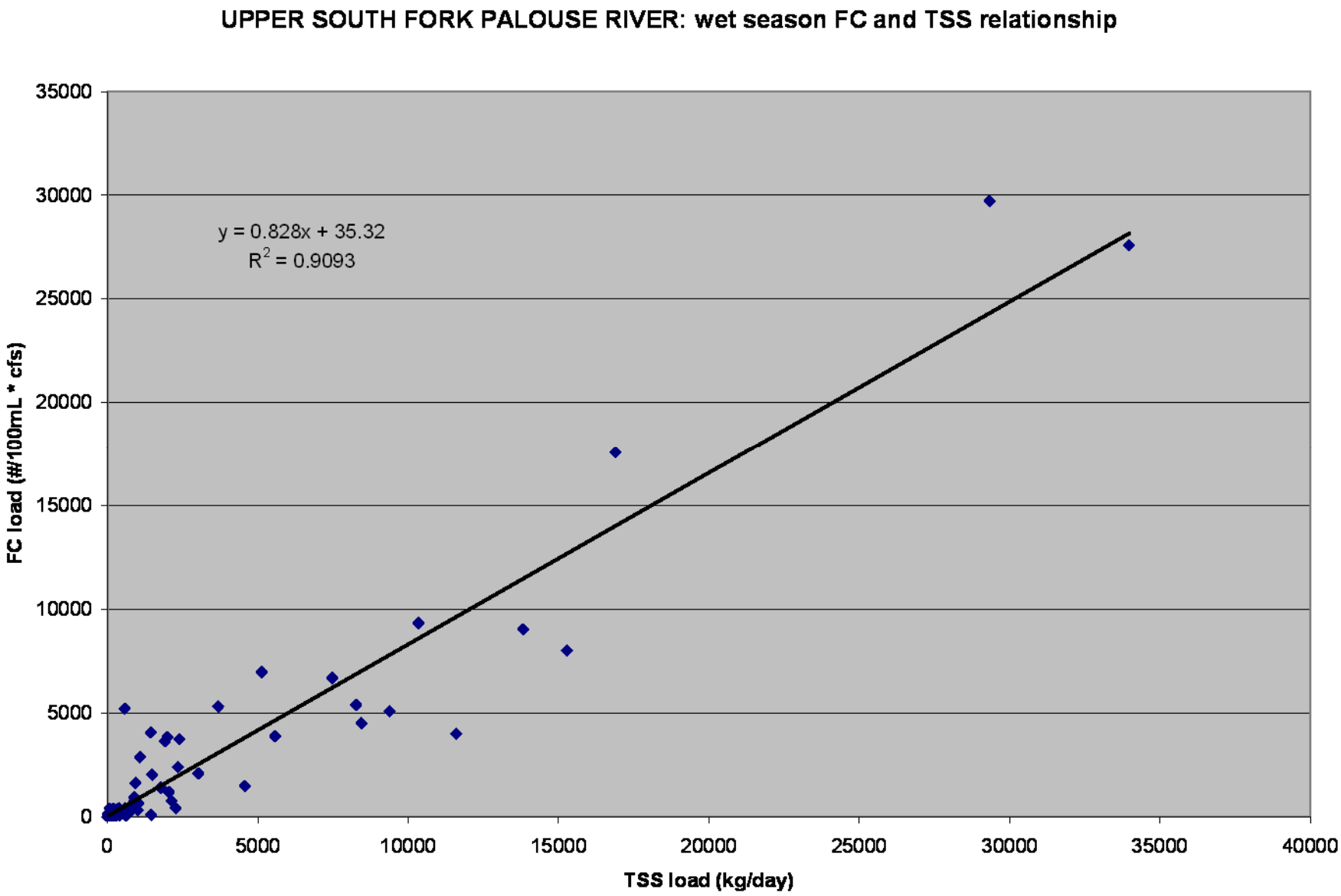
- Cows generate 5.4 billion FC bacteria per day for one cow:

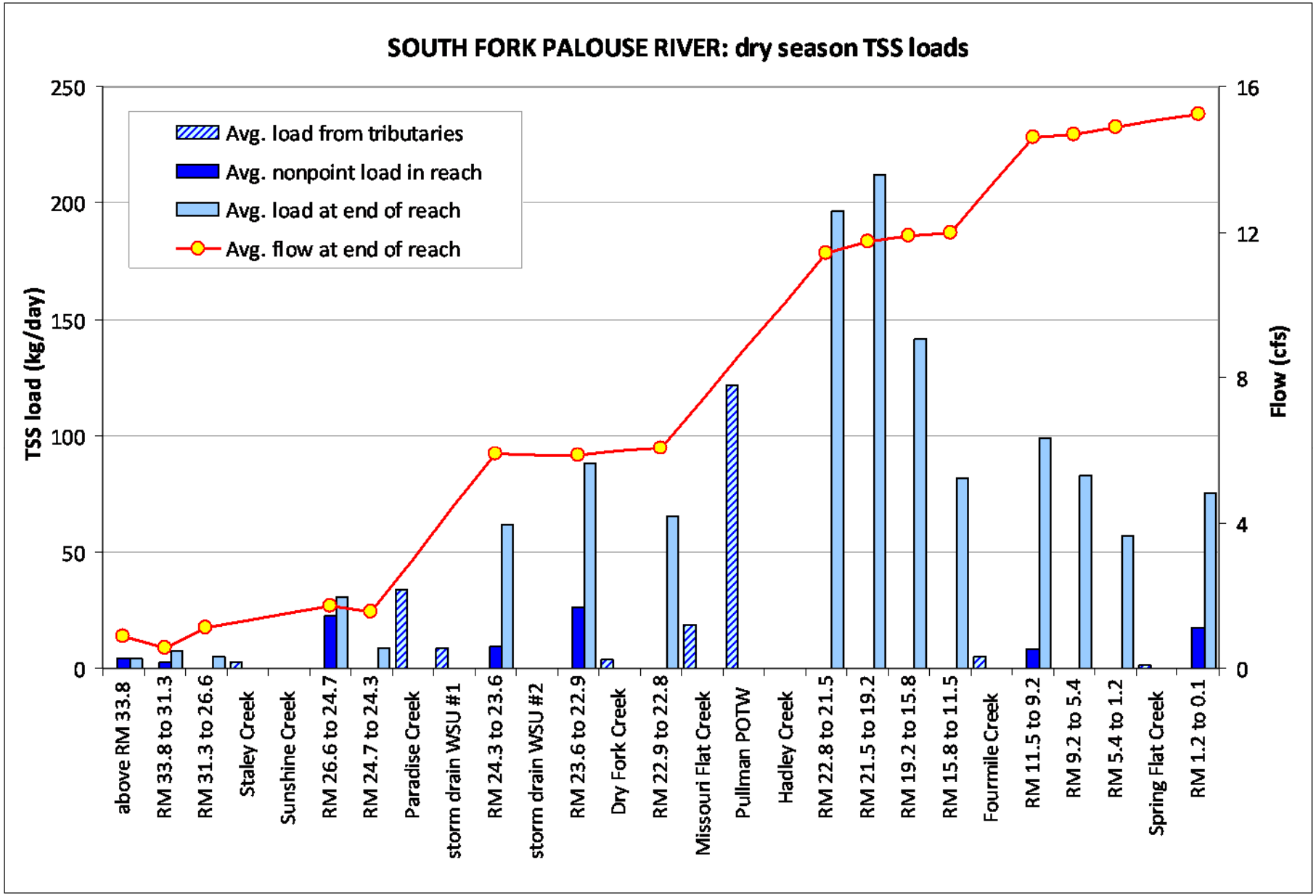
  ≈ 45 cows

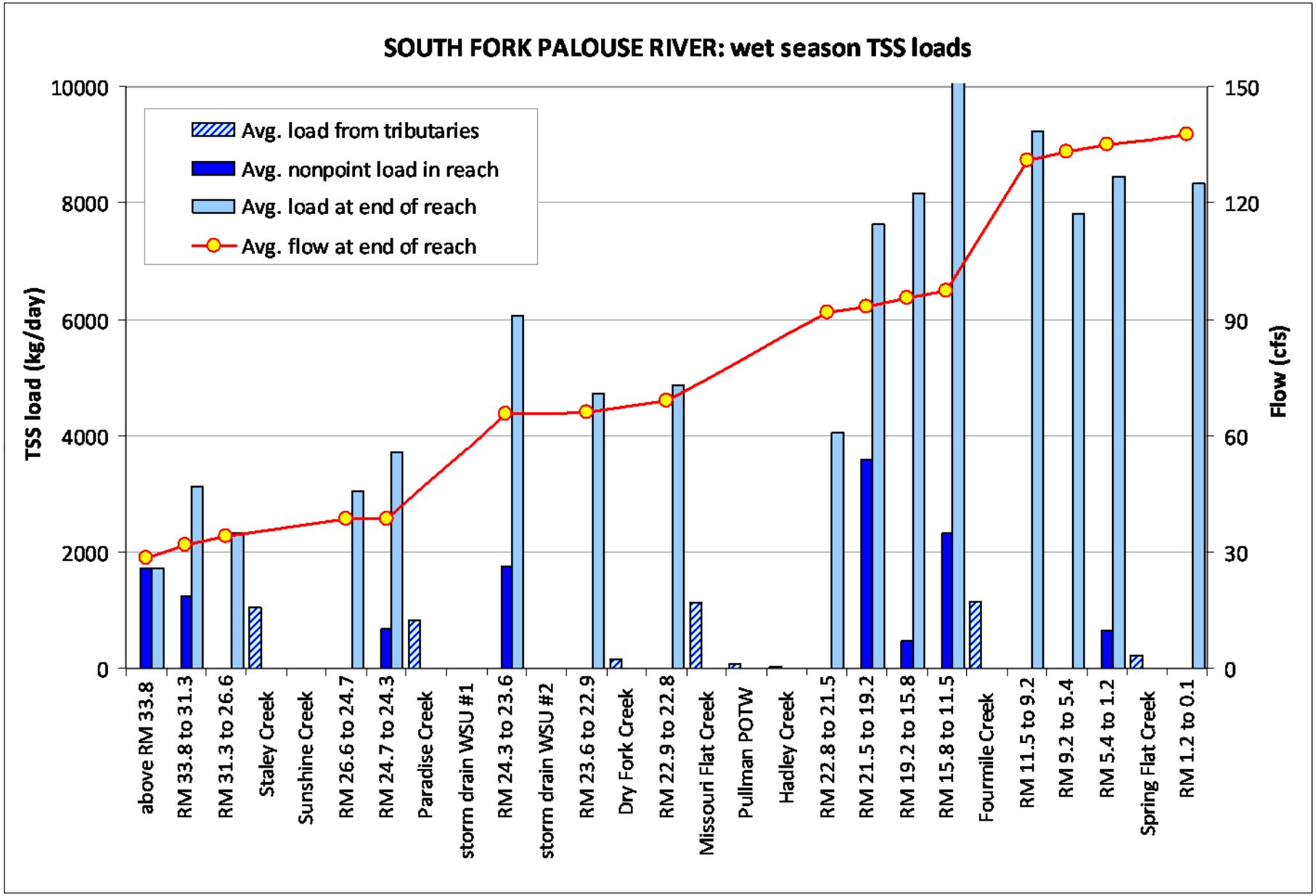
- Gulls generate 0.1 billion FC bacteria per day for one gull:

  ≈ 2500 gulls


10000
8000
6000
4000
2000
0
TSS load (kg/day)
Idaho (SF Palouse)
Idaho (Paradise)
Idaho (Missouri Flat)
Whitman County (SF Palouse)
Whitman County (Paradise)
Whitman County (Missouri Flat)
Pullman (and WSU storm drains)
Whitman County (below Pullman)
Colfax
dryseason
wetseason


UPPER SOUTH FORK PALOUSE RIVER: wet season FC and TSS relationship
y = 0.828x + 35.32
R2 = 0.9093
FC load (#/100mL * cfs)
TSS load (kg/day)
0
5000
10000
15000
20000
25000
30000
35000
40000


SOUTH FORK PALOUSE RIVER: dry season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
250
200
150
100
50
0
16
12
8
4
0
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1


SOUTH FORK PALOUSE RIVER: wet season TSS loads
Avg. load from tributaries
Avg. nonpoint load in reach
Avg. load at end of reach
Avg. flow at end of reach
TSS load (kg/day)
Flow (cfs)
10000
8000
6000
4000
2000
0
150
120
90
60
30
0
above RM 33.8
RM 33.8 to 31.3
RM 31.3 to 26.6
Staley Creek
Sunshine Creek
RM 26.6 to 24.7
RM 24.7 to 24.3
Paradise Creek
storm drain WSU #1
RM 24.3 to 23.6
storm drain WSU #2
RM 23.6 to 22.9
Dry Fork Creek
RM 22.9 to 22.8
Missouri Flat Creek
Pullman POTW
Hadley Creek
RM 22.8 to 21.5
RM 21.5 to 19.2
RM 19.2 to 15.8
RM 15.8 to 11.5
Fourmile Creek
RM 11.5 to 9.2
RM 9.2 to 5.4
RM 5.4 to 1.2
Spring Flat Creek
RM 1.2 to 0.1