South Lakes High School Stream Restoration Monitoring Project
Review and Discussion of the 10-Year Study

South Lakes High School
Reston Association
U.S. Geological Survey

Agenda

* Review last year's presentation of 9-year study results
* Discuss 2018 monitoring data: 10-year trends
    - Temperature
    - Habitat
    - Macroinvertebrates
    - Chemistry
* Goals for future monitoring (should it continue?)
* What to do with the data?
* Roles for partners in future monitoring
    - Overall coordination
    - Lead responsibilities for each monitoring category
    - Changes in individual contributions
* Other Issues: Data archival, sample storage, etc.

Monitoring Post-Restoration Recovery in Snakeden Branch, Reston: A Partnership in Citizen Science

South Lakes High School
Reston Association
U.S. Geological Survey

Goals of the Partnership

- Assess effectiveness of restoration of Reston's streams using indicators of biological condition
- Develop a Citizen Science approach that provides education opportunities to local high-school students
- Gather information useful to Reston Association in addressing public information requests and concerns
- Collaborate with Wetland Studies and Solutions, Inc. in design, methods, and information exchange

Goals for today

- SLHS and WSSI share results and observations … 9 years of post-restoration data!
- Discuss interpretations and opportunities to improve the study
- Discuss sharing of results with public through the Reston Annual State of the Environment Report (RASER)

Study Description

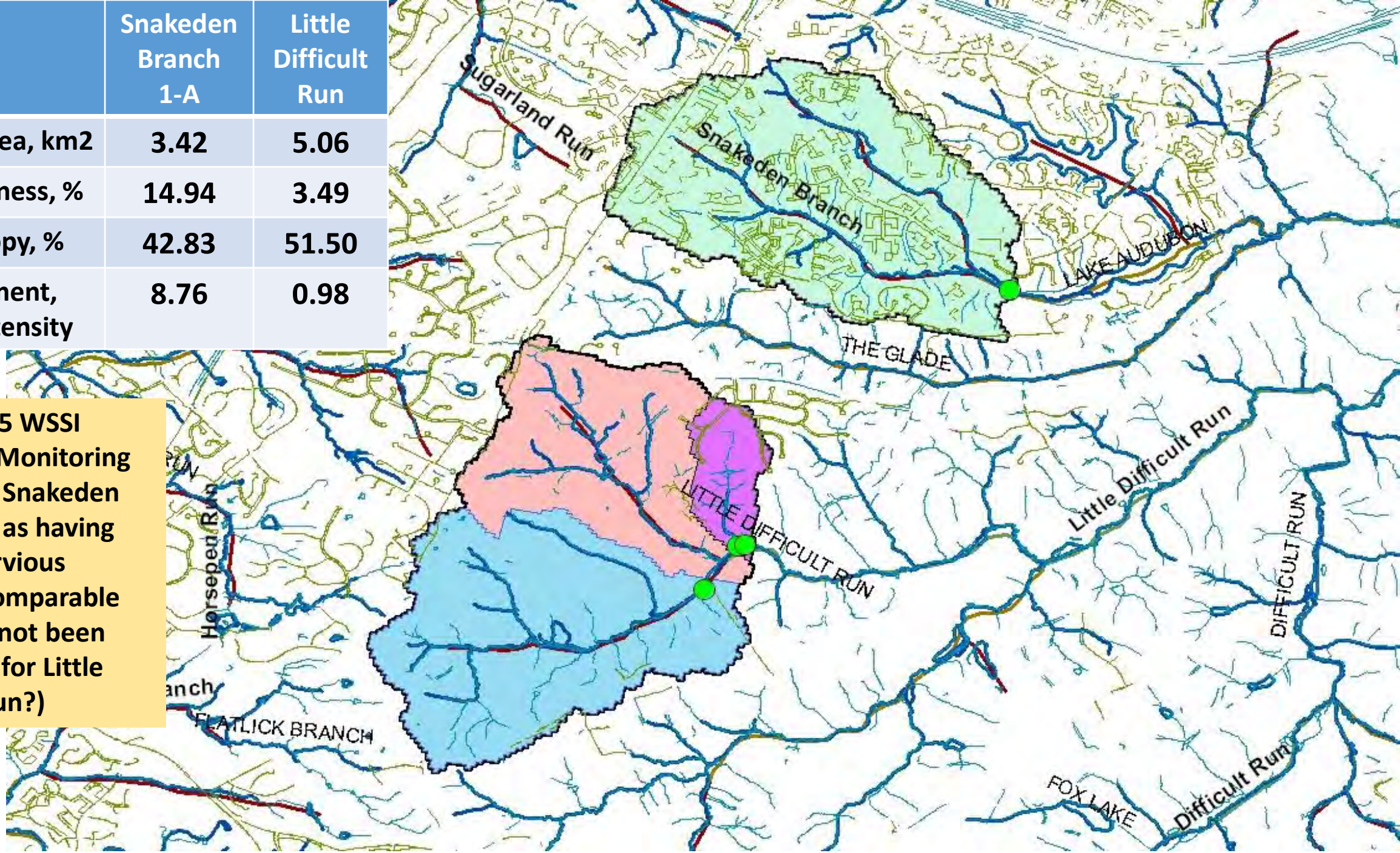
- Sample 2 reaches in Snakeden Branch (within walking distance of South Lakes High School) and a “reference” reach in Little Difficult Run (unrestored stream with less development)
- Each of 2 Advanced Biology classes sample one reach in Snakeden Branch; Little Difficult Run sampled by mentors
- Began monitoring in 2009 (9 years of data so far)
- Sample in Fall to complement WSSI’s Spring sampling
- Use standard protocols to allow long-term comparability and comparisons with other sampling programs

Study Description - *continued*

- **Hydrology**: use flow data from Little Difficult Run near Vienna, VA
- **Chemistry**: Hach kits and meters
- **Habitat**: Virginia DEQ methods (based on EPA)
- **Invertebrates**: Virginia DEQ Multi-Habitat methods (based on EPA)
- Training in invertebrate sample processing methods and identifications by WSSI staff; field consult by Va-DEQ staff

	Snakeden Branch 1-A	Little Difficult Run
Drainage area, km2	3.42	5.06
Imperviousness, %	14.94	3.49
Forest Canopy, %	42.83	51.50
% Development, Medium Intensity	8.76	0.98

NOTE: 2015 WSSI Biological Monitoring Report for Snakeden shows 1-A as having 38% Impervious Surface (comparable data have not been calculated for Little Difficult Run?)



Snakeden Branch 1-A

October 2009

April 2014

Little Difficult Run


HOLLISTER


EAGLE

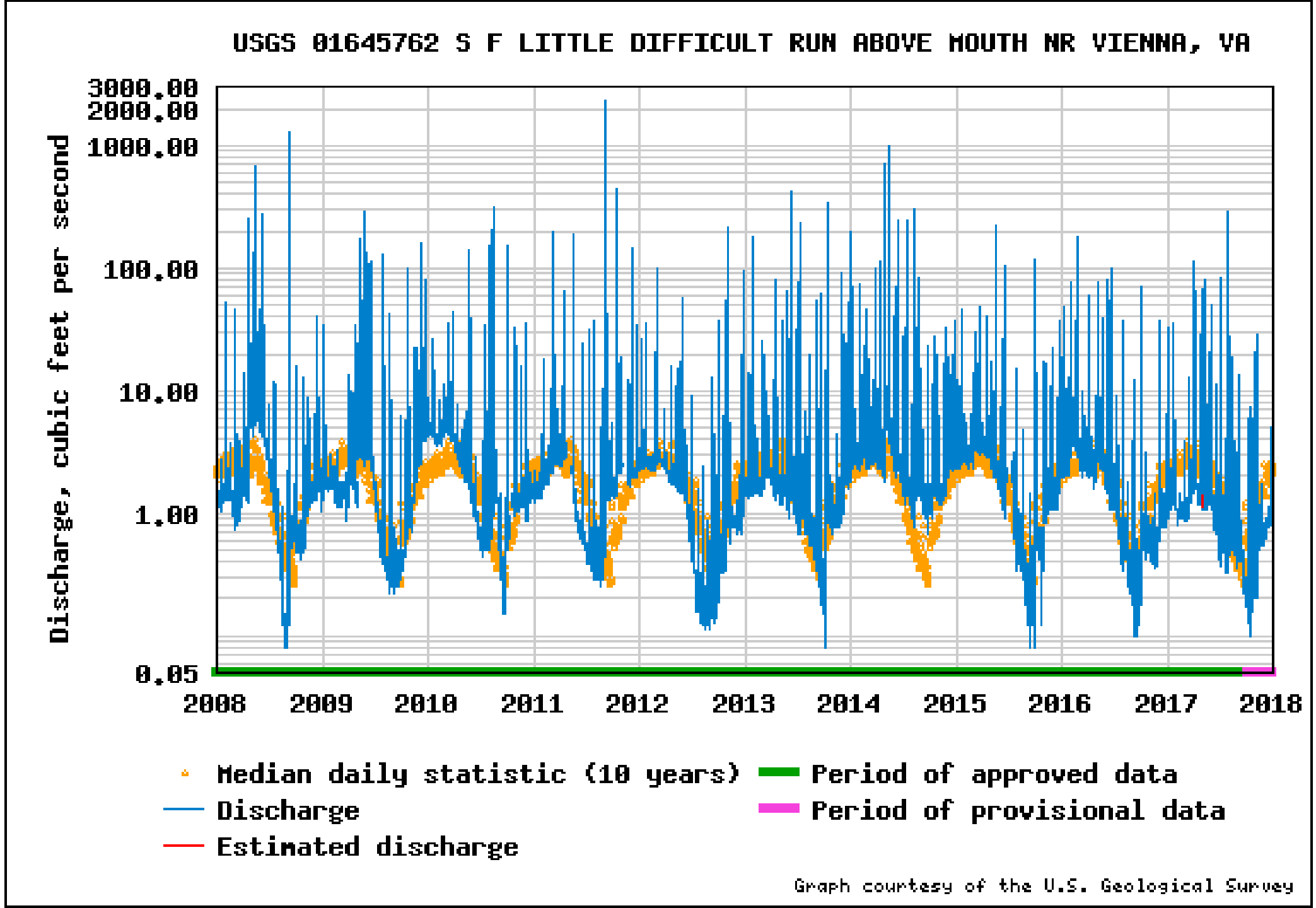

01/17/2011


NEVER ONLINE


10/08/2010


USGS
USGS
FIELD & STREAM


10
70% Isopropyl Rubbing Alcohol
70% Isopropyl Rubbing Alcohol


USGS 01645762 S F LITTLE DIFFICULT RUN ABOVE MOUTH NR VIENNA, VA
Discharge, cubic feet per second
3000.00
2000.00
1000.00
100.00
10.00
1.00
0.05
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Median daily statistic (10 years)
Discharge
Estimated discharge
Period of approved data
Period of provisional data
Graph courtesy of the U.S. Geological Survey


A Stream at Risk

USGS 01645762 S F LITTLE DIFFICULT RUN ABOVE MOUTH NR VIENNA, VA

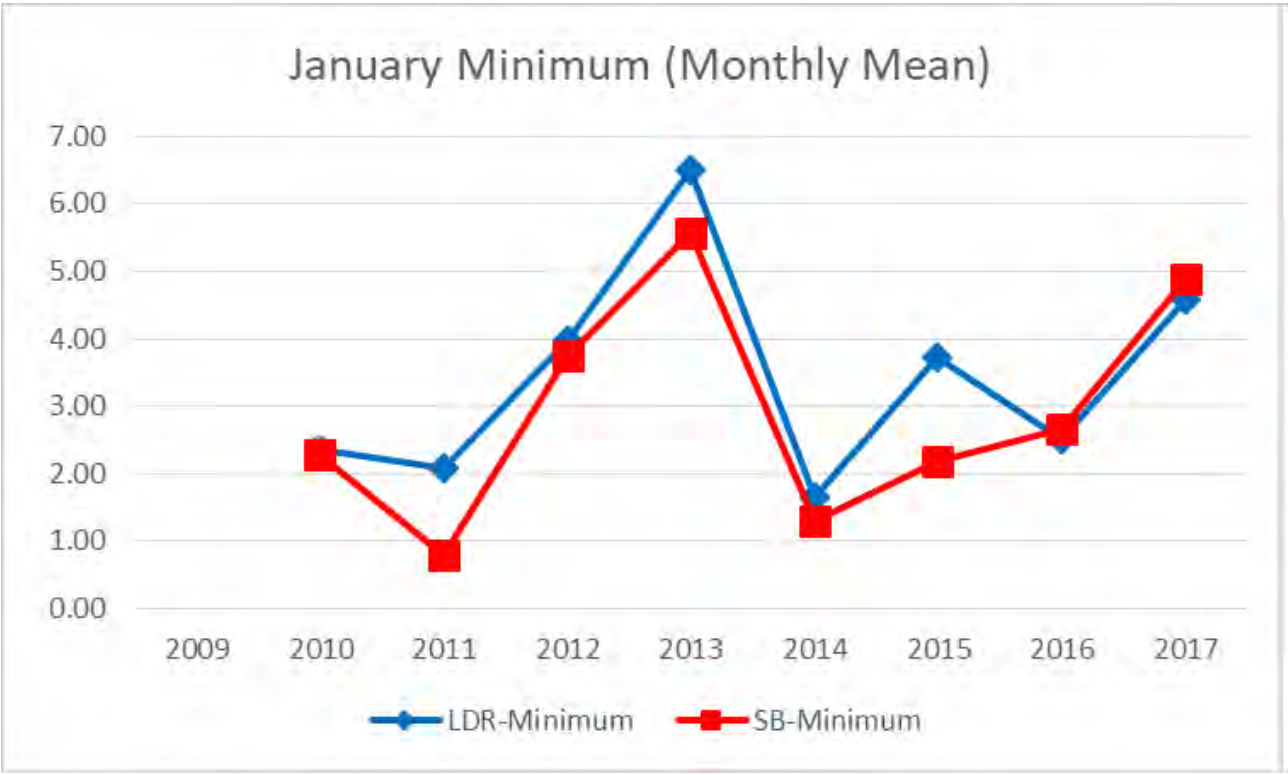
	Sampling Dates			Discharge			Maximum in previous 30 days			# days before sampling		
	Snakeden 1-A	Snakeden 1-B	Little Difficult Run	Snakeden 1-A	Snakeden 1-B	Little Difficult Run	Snakeden 1-A	Snakeden 1-B	Little Difficult Run	Snakeden 1-A	Snakeden 1-B	Little Difficult Run
2009	10/20	10/21	10/12	0.65	0.66	0.52	3.29	3.29	1.30	2	3	15
2010	10/8	10/8	10/20	0.72	0.72	0.52	32.50	32.50	32.50	8	8	20
2011	9/30	9/30	10/4	1.45	1.45	1.57	283.00	283.00	283.00	25	25	21
2012	10/19	10/16	10/16	1.17	0.37	0.37	4.97	4.97	4.97	17	14	14
2013	10/15	10/15	10/15	1.03	1.03	1.03	95.60	95.60	95.60	4	4	4
2014	10/3	10/3	10/3	1.22	1.22	1.22	6.38	6.38	6.38	8	8	8
2015	9/28	9/28	9/28	0.20	0.20	0.20	0.75	0.75	0.75	6	6	6
2016	9/21	9/21	9/21	0.22	0.22	0.22	1.28	1.28	1.28	13	13	13
2017	9/20	9/20	9/20	0.32	0.32	0.32	3.26	3.26	3.26	15	15	15

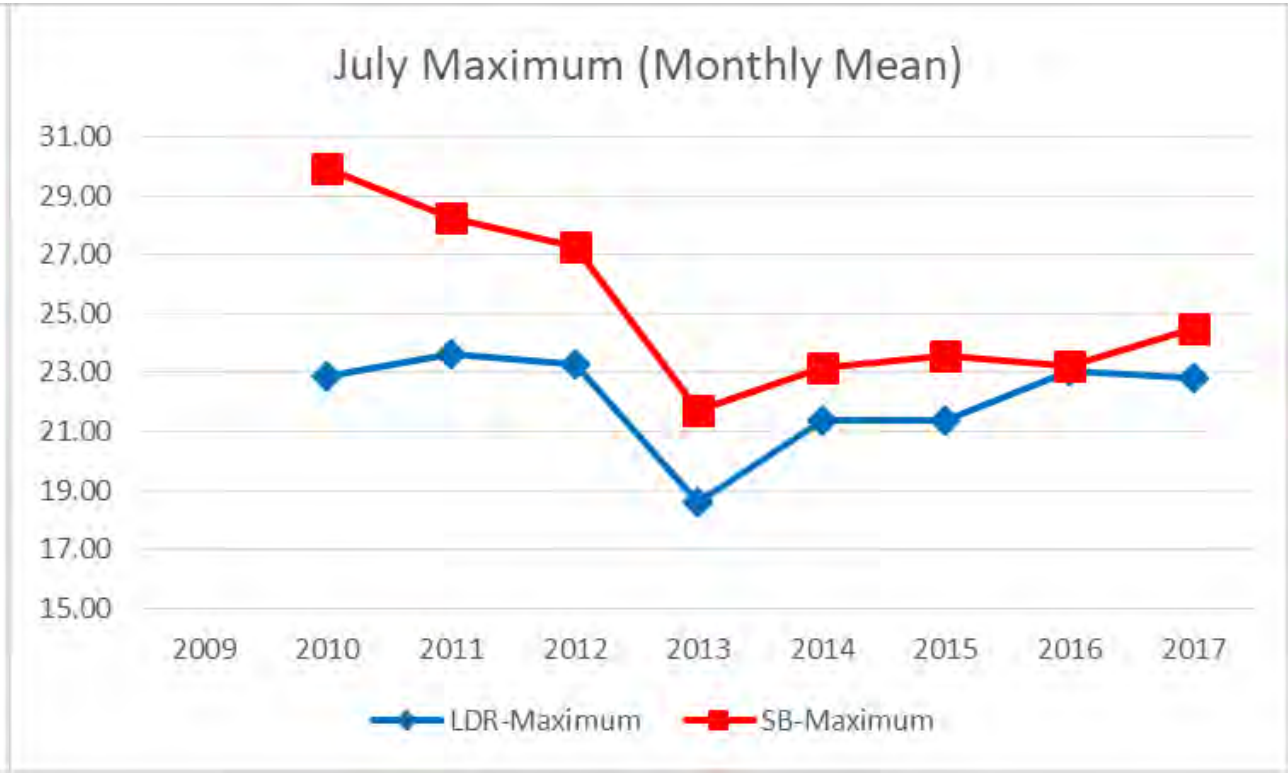
Peak Streamflows

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
2008	6-Sep-2008	5.3	1,290
2009	26-May-2009	3.42	289
2010	18-Aug-2010	3.45	308
2011	8-Sep-2011	6.18	2,360
2012	13-Oct-2012	3.55	433
2013	10-Jun-2013	3.28	417
2014	16-May-2014	4.71	998
2015	27-Jun-2015	5.22	1,340
2016	24-Feb-2016	2.39	180

data from: https://nwis.waterdata.usgs.gov/

Temperature, C





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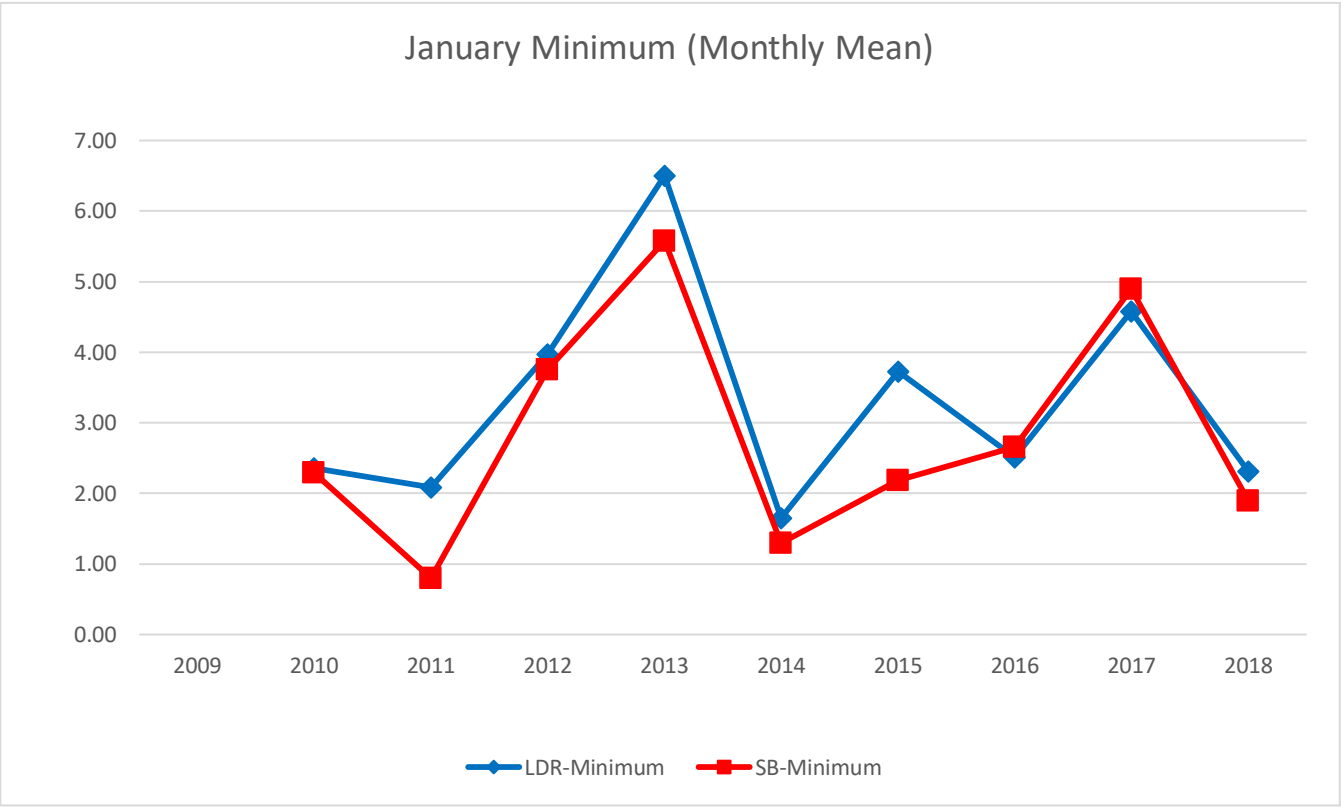
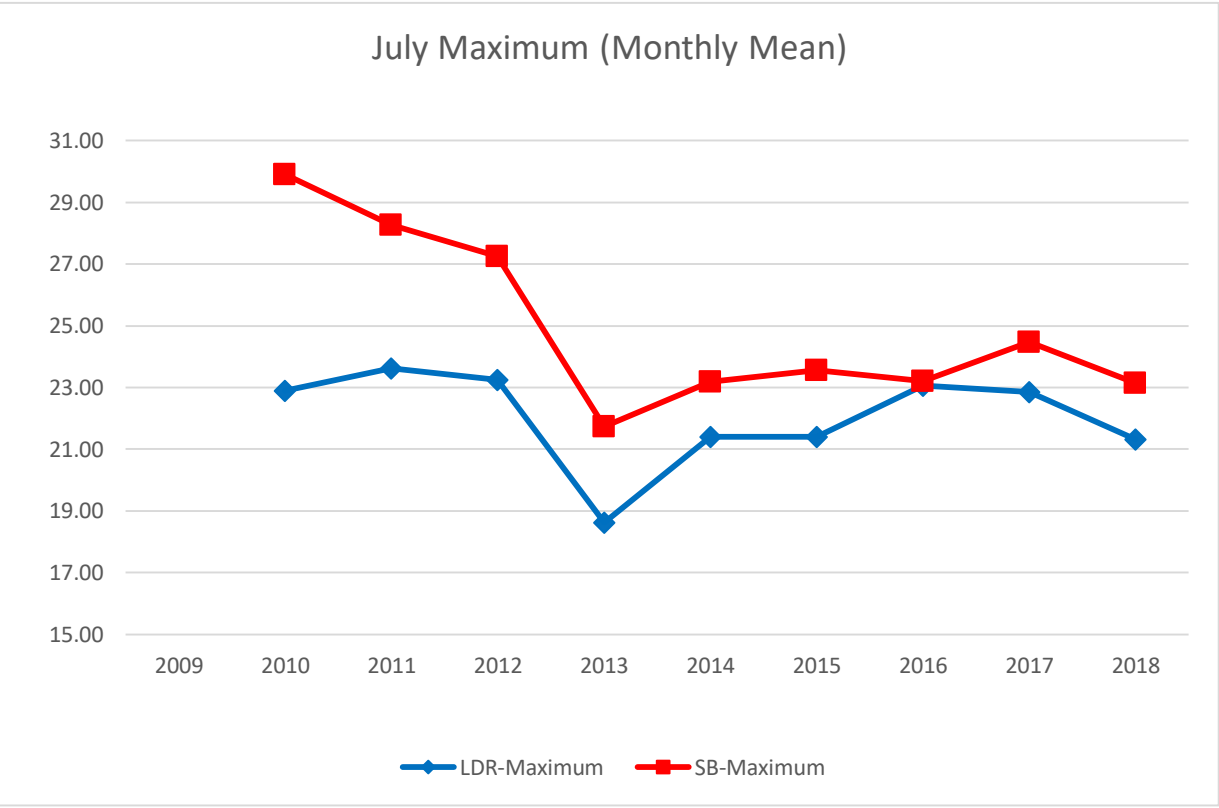
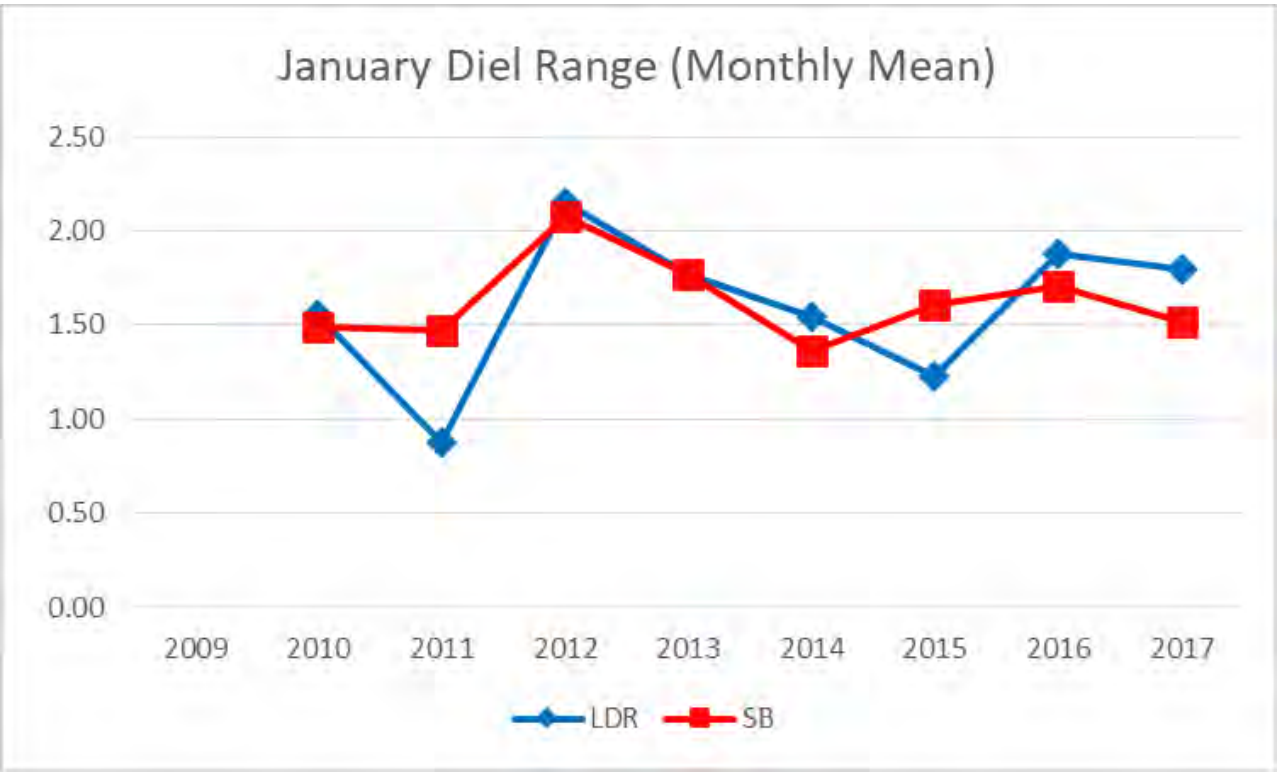
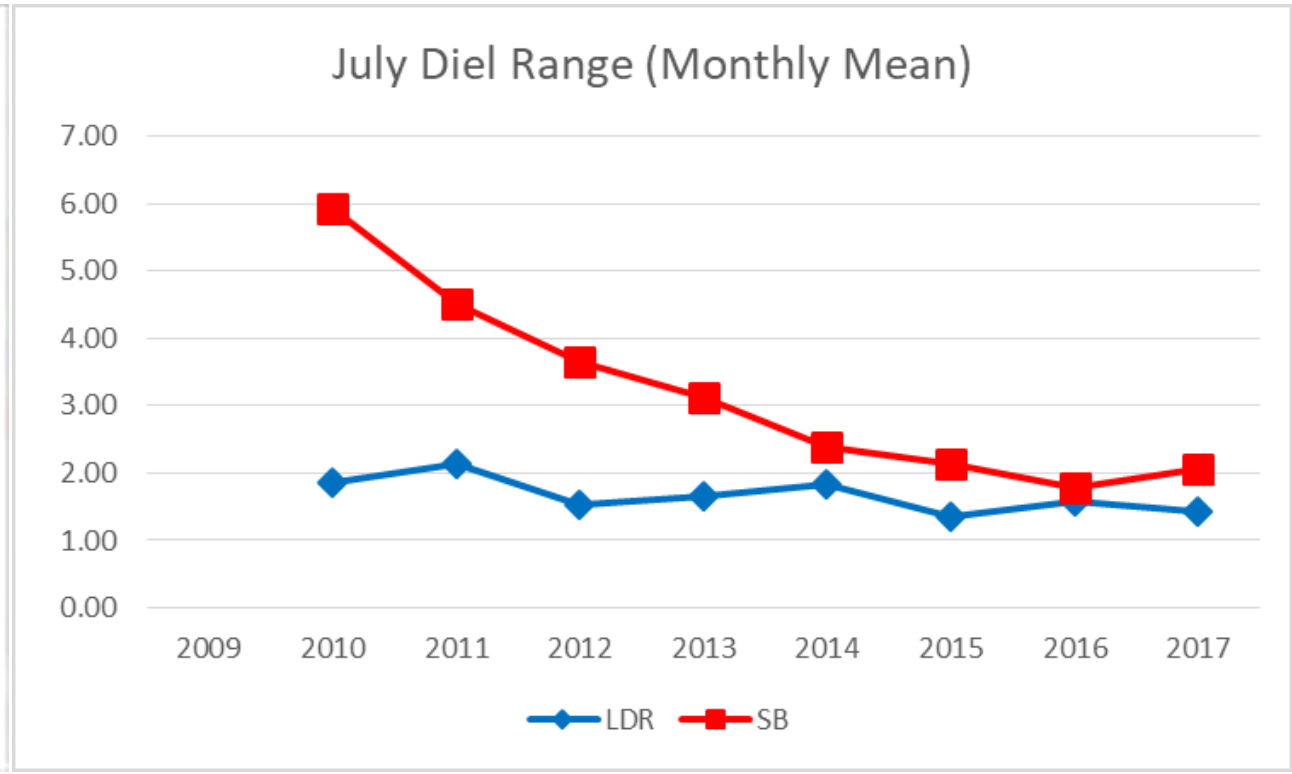


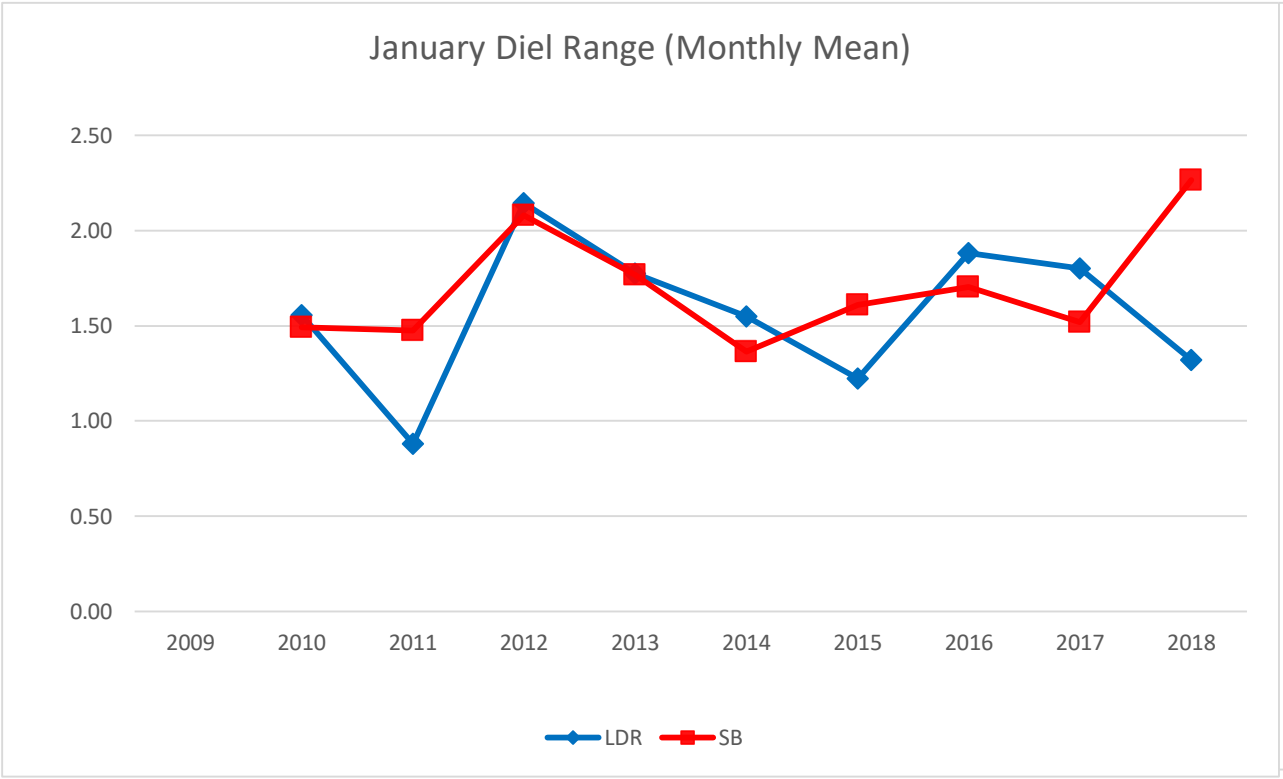


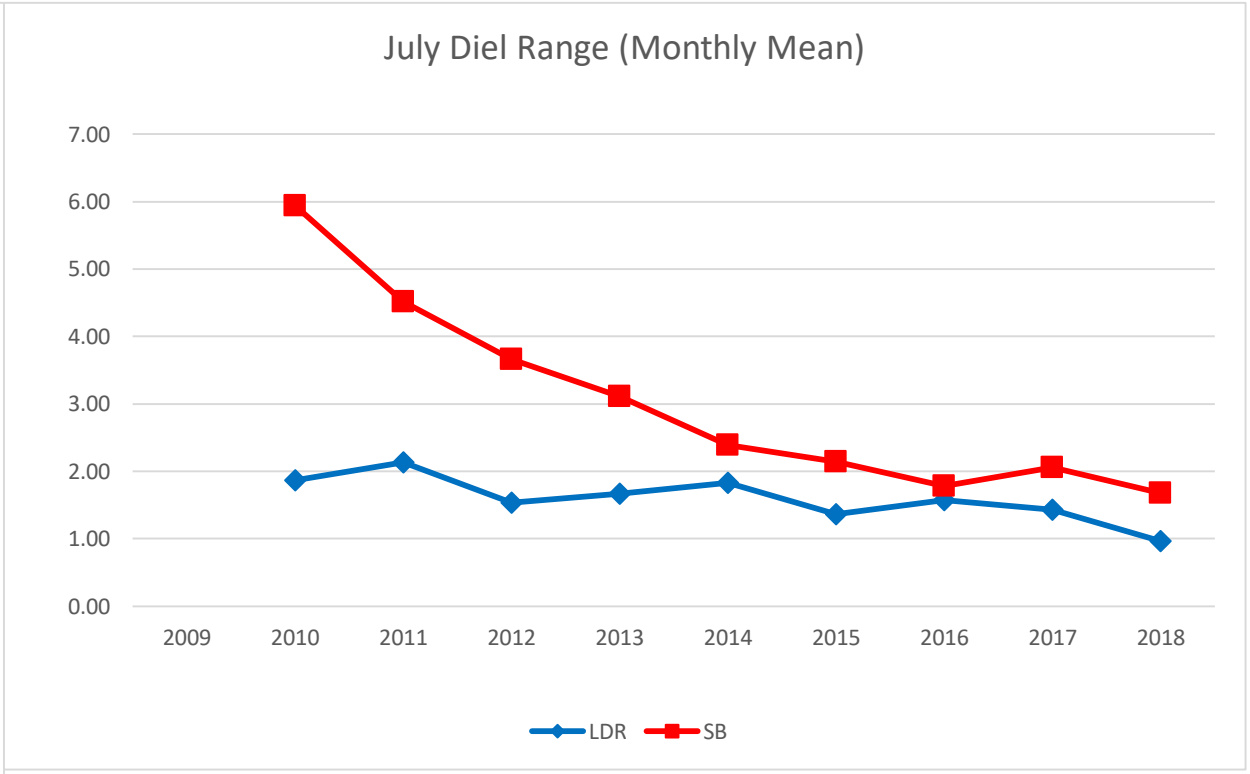
Temperature, C

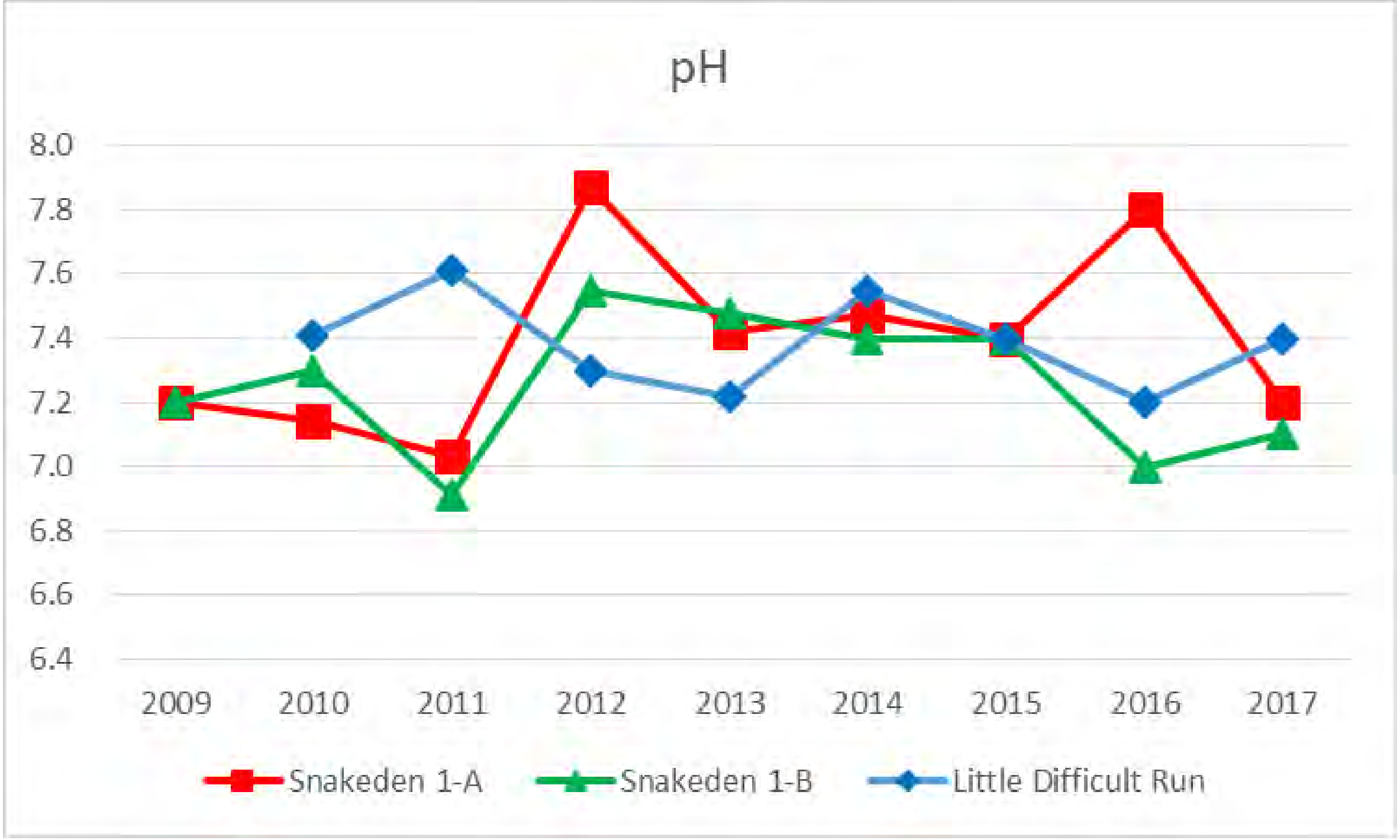




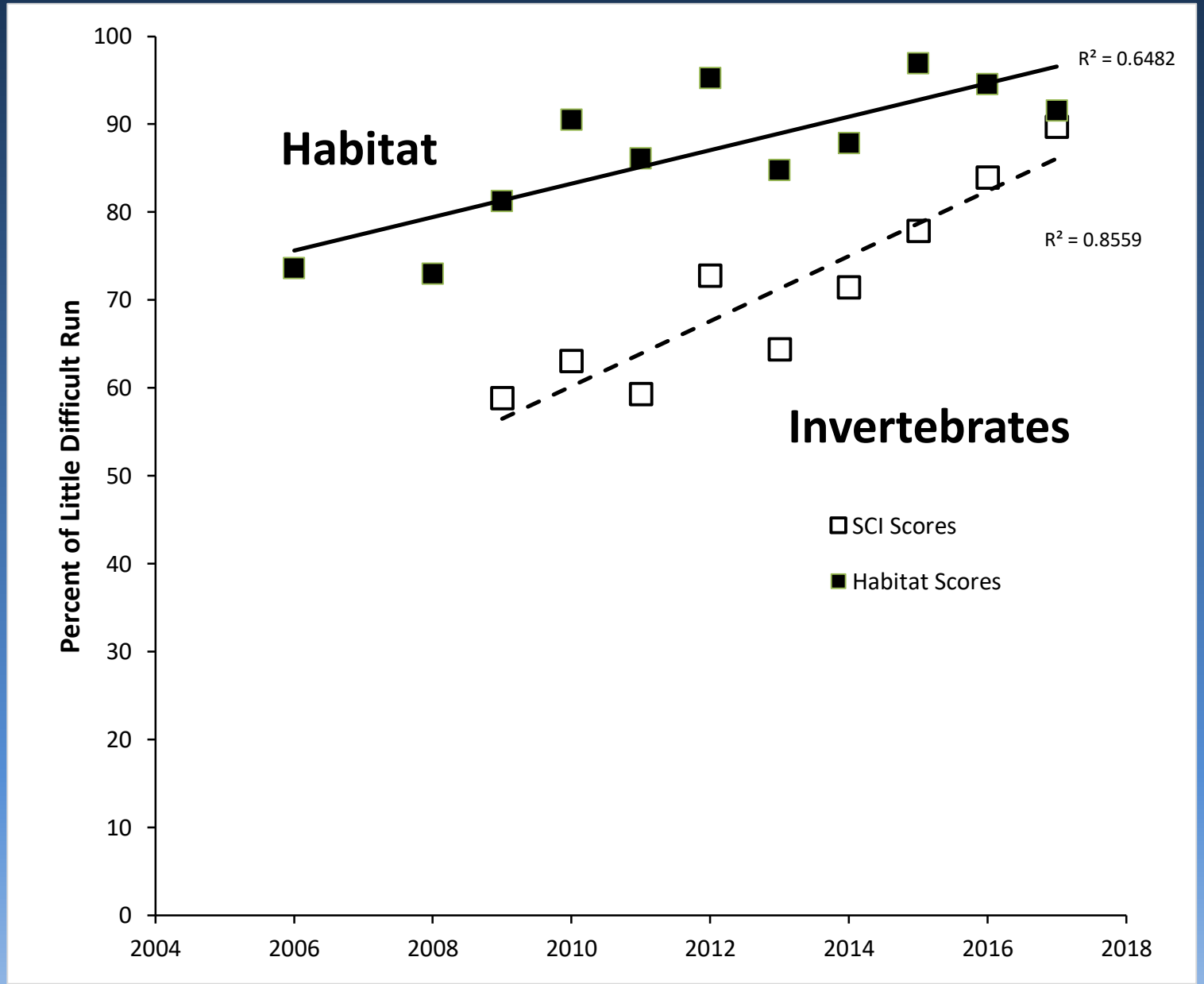
Temperature, C






pH
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
2009
2010
2011
2012
2013
2014
2015
2016
2017
Snakeden 1-A
Snakeden 1-B
Little Difficult Run

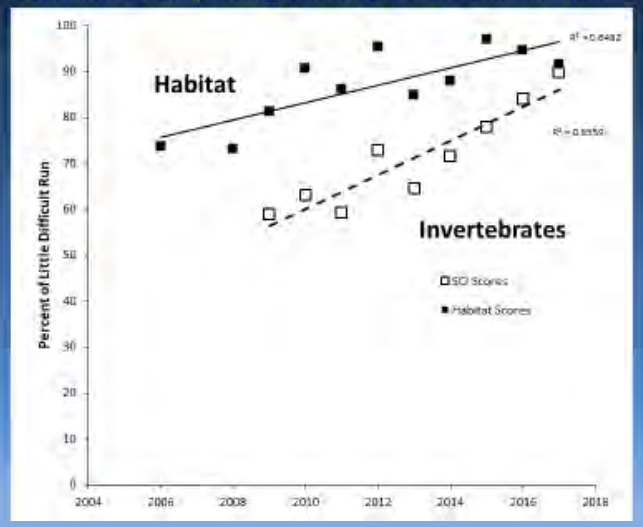
The Punch Line: Both Habitat and Invertebrates in Snakeden Branch are Improving Relative to Little Difficult Run

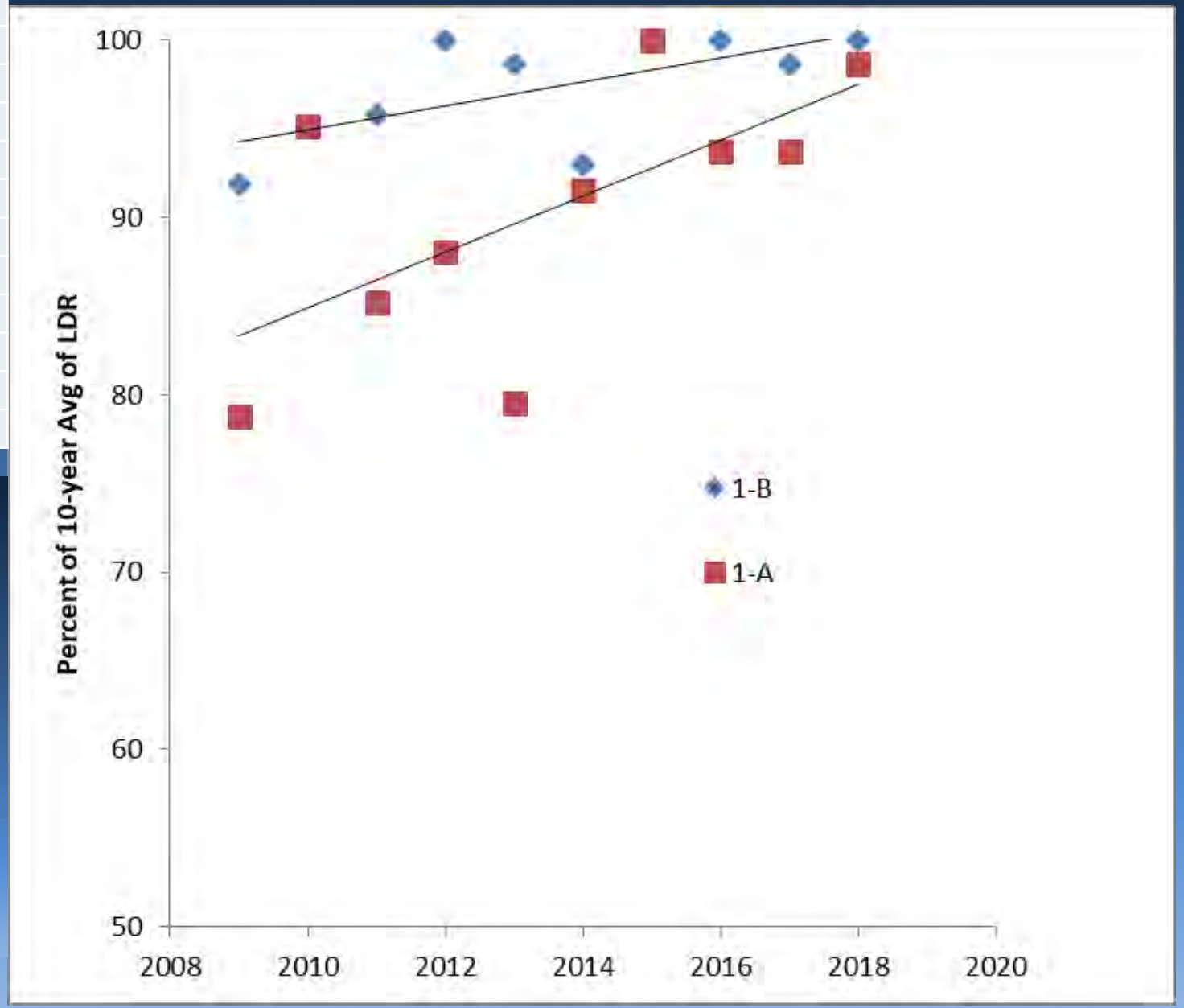


The Habitat Story with 2018 Data Added Showing both Snakeden 1-A and 1-B

YEAR	LDR	1-A	1-A/140.9	1-B	1-B/140.9	SDAVG	SDAVG/140.9
2009	151	111	78.8	129.5	91.9	120.25	85.3
2010	147	134	95.1	134	95.1	134	95.1
2011	148	120	85.2	135	95.8	127.5	90.5
2012	127	124	88.0	158	100.0	141	100.0
2013	111	112	79.5	139	98.7	125.5	89.1
2014	120	129	91.6	131	93.0	130	92.3
2015	152	141	100.0	146	100.0	143.5	100.0
2016	151	132	93.7	148	100.0	140	99.4
2017	150	132	93.7	139	98.7	135.5	96.2
2018	152	139	98.7	142	100.0	140.5	99.7
AVG	140.9	127.4	90.4	140.2	97.3	133.8	94.8
SD	14.6	9.9	7.0	8.3	3.0	7.3	5.0

The Punch Line: Both Habitat and Invertebrates in Snakeden Branch are Improving Relative to Little Difficult Run

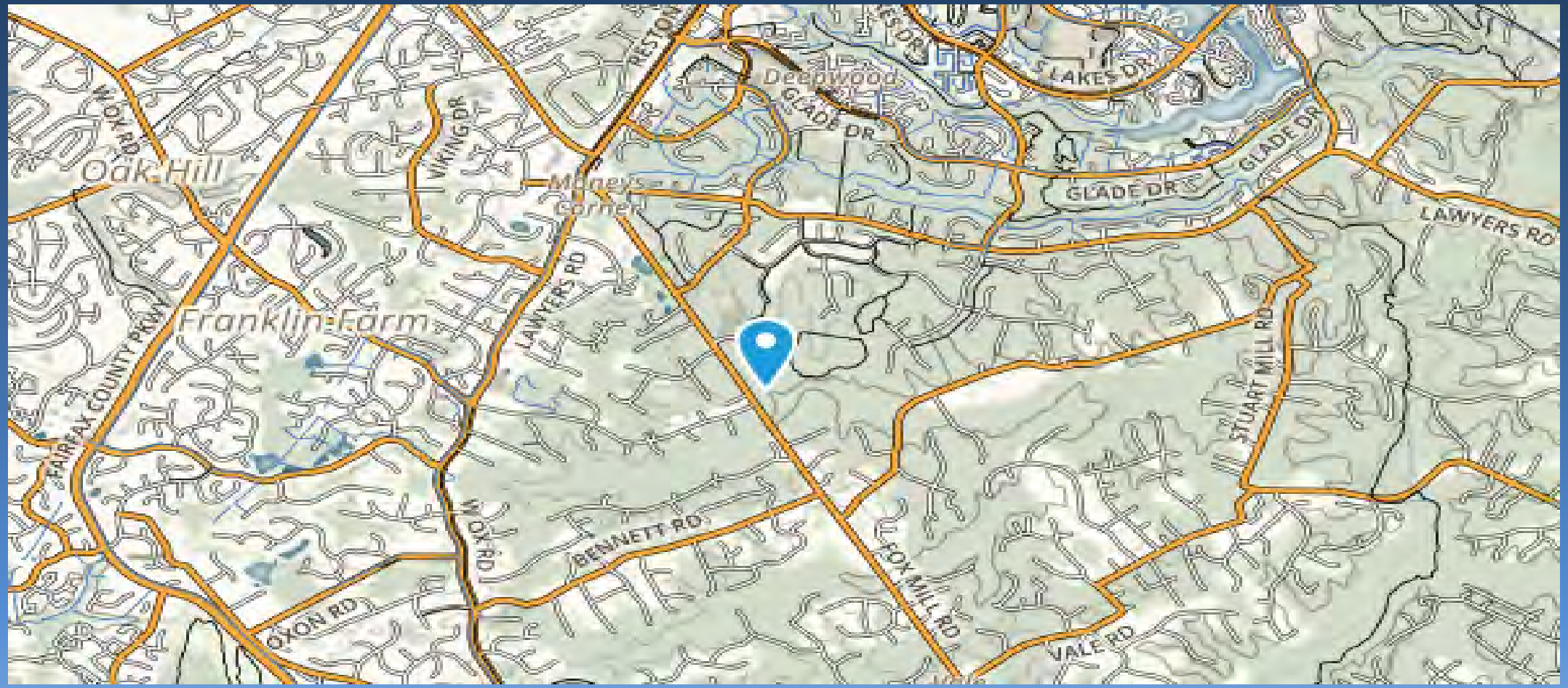




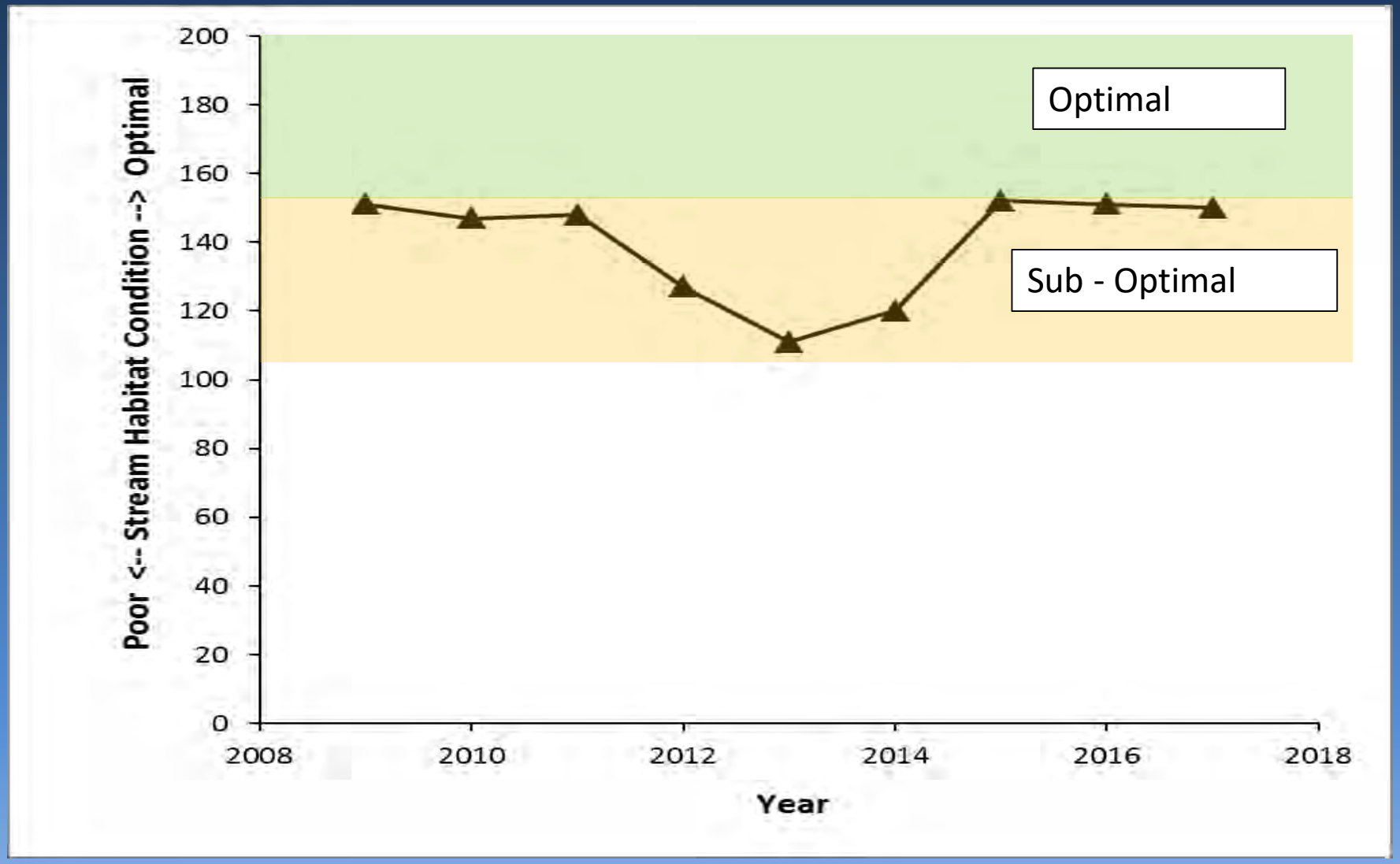
The Snakeden Habitat Marathon: It’s Been a Little Difficult Run

Little Difficult Run

Little Difficult Run:
A reference stream in an urban context



Little Difficult Run:
Habitat Assessment Scores



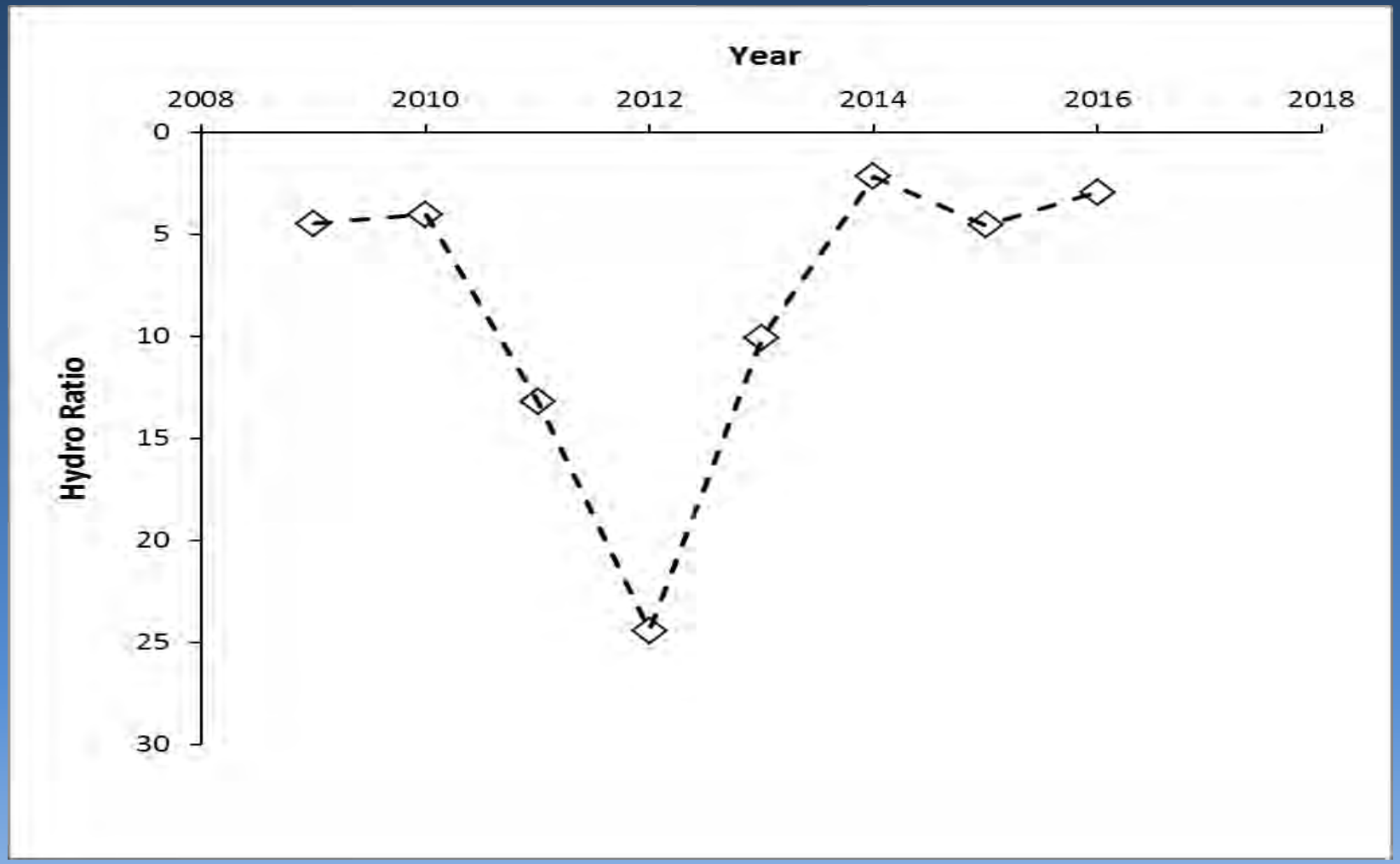
Why the Variation?: Streamflow

- Notes suggest that in 2013 there was significant bank erosion and increased sediment deposition and embeddedness consistent with prior channel altering flows

- Stable channel reference streams may experience short-term variations in stream slope, shape, and dimensions as a result of floods and variation in the hydrologic regime (paraphrased from the EPA Habitat Bioassessment Protocol Manual)

Little Difficult Run

Ratio of Mean October Flow to Minimum September Flow



Little Difficult Run: Summary

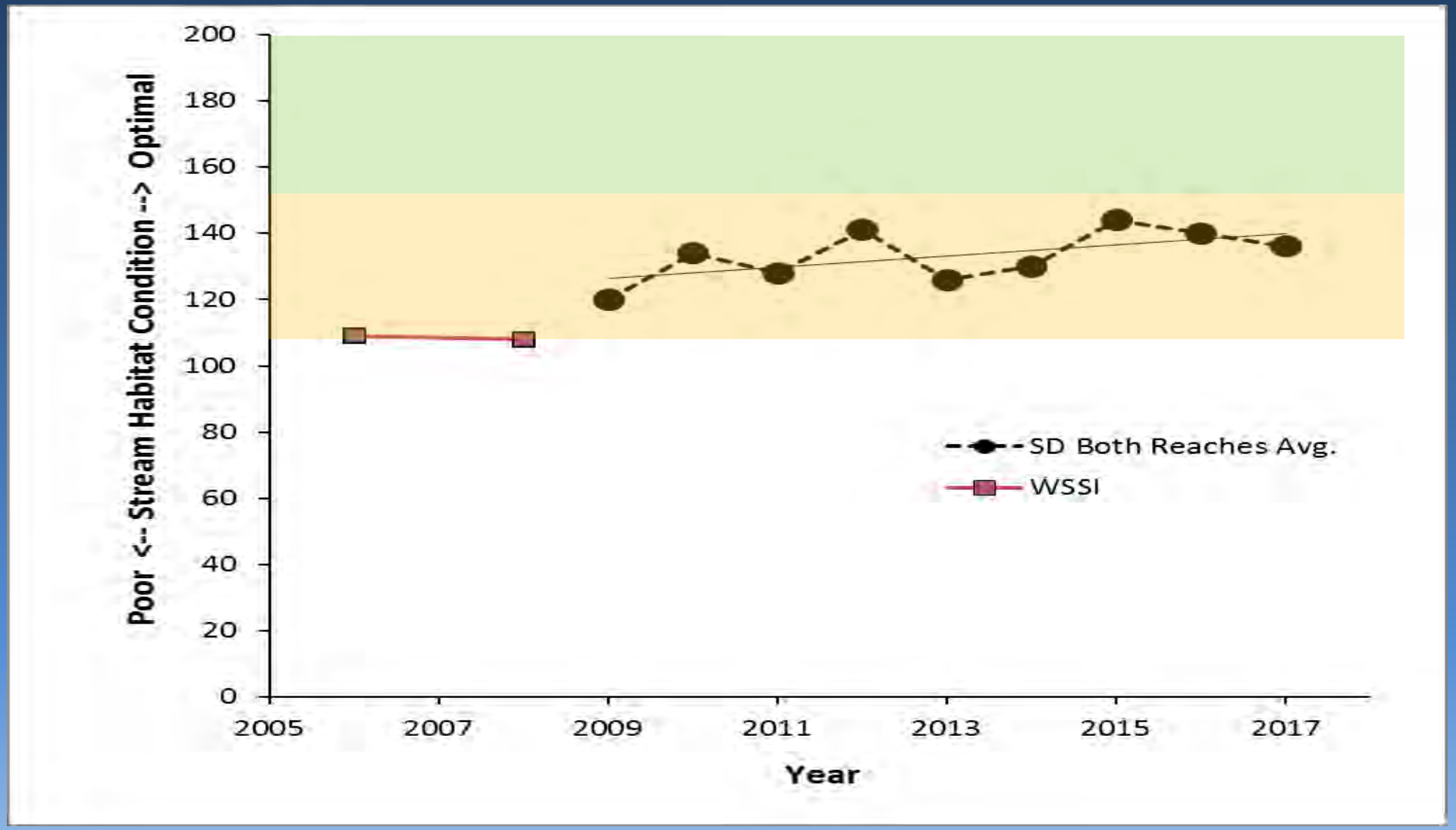
- As a reference, Little Difficult Run's sub-optimal habitat is "best attainable"
- "Natural" habitat variability driven by hydrologic regime covers the range of sub-optimal

Snakeden:
An Urban Stream

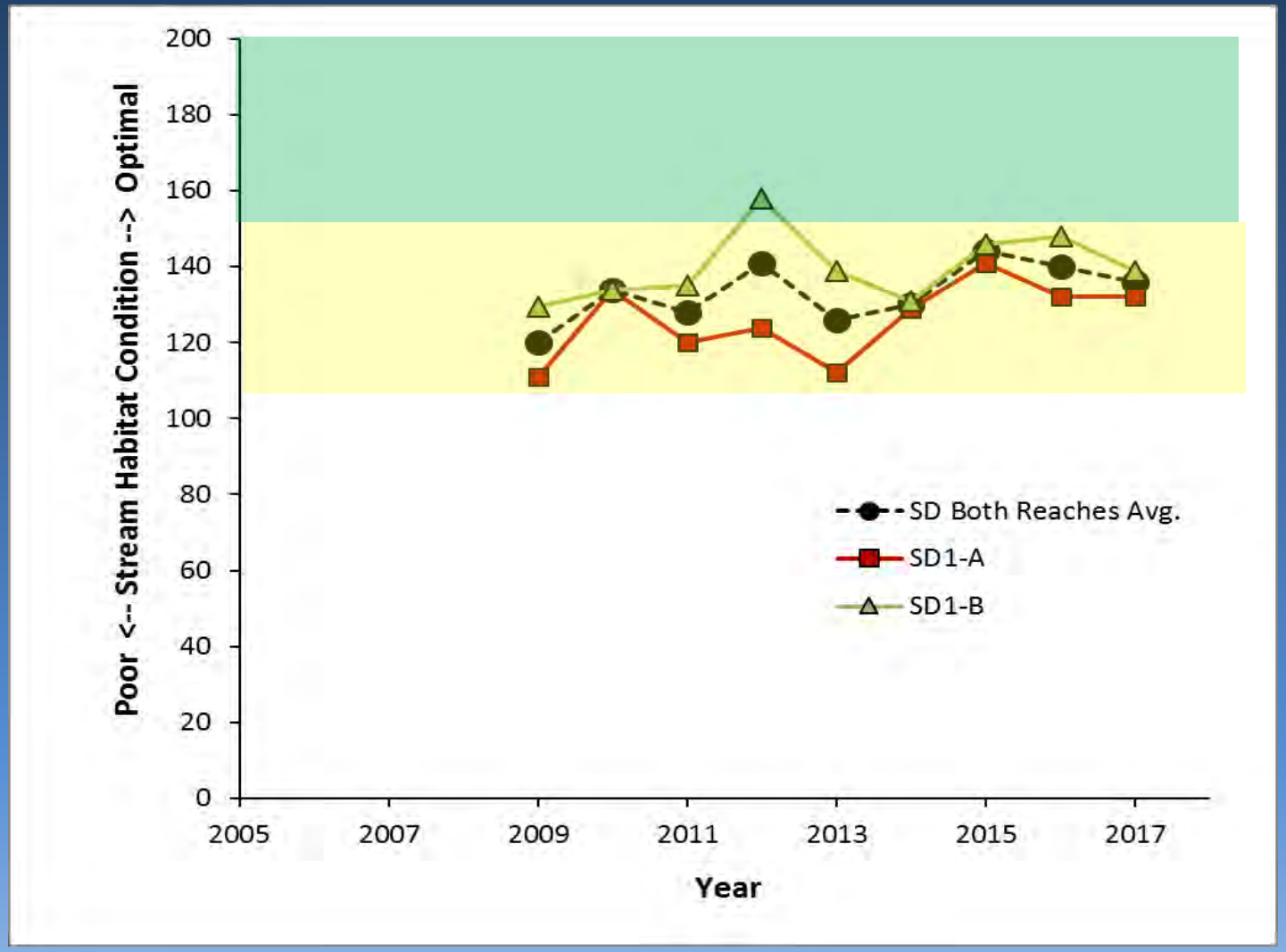
Snakeden: Pre-Restoration

Snakeden: Restoration

Snakeden:
Habitat Assessment Scores



Snakeden:
Habitat Assessment Scores



Snakeden: Summary

- Limited inferences from 2006 and 2008 suggest improvement since 2009
- Snakeden habitat consistently sub-optimal, BUT similar to sub-optimal of Little Difficult Run
- Reach B in general scored higher than Reach A, likely a result of sediment from tributary above Reach A
- Anecdotal evidence suggests potential for future changes in habitat

2014

2016

2017

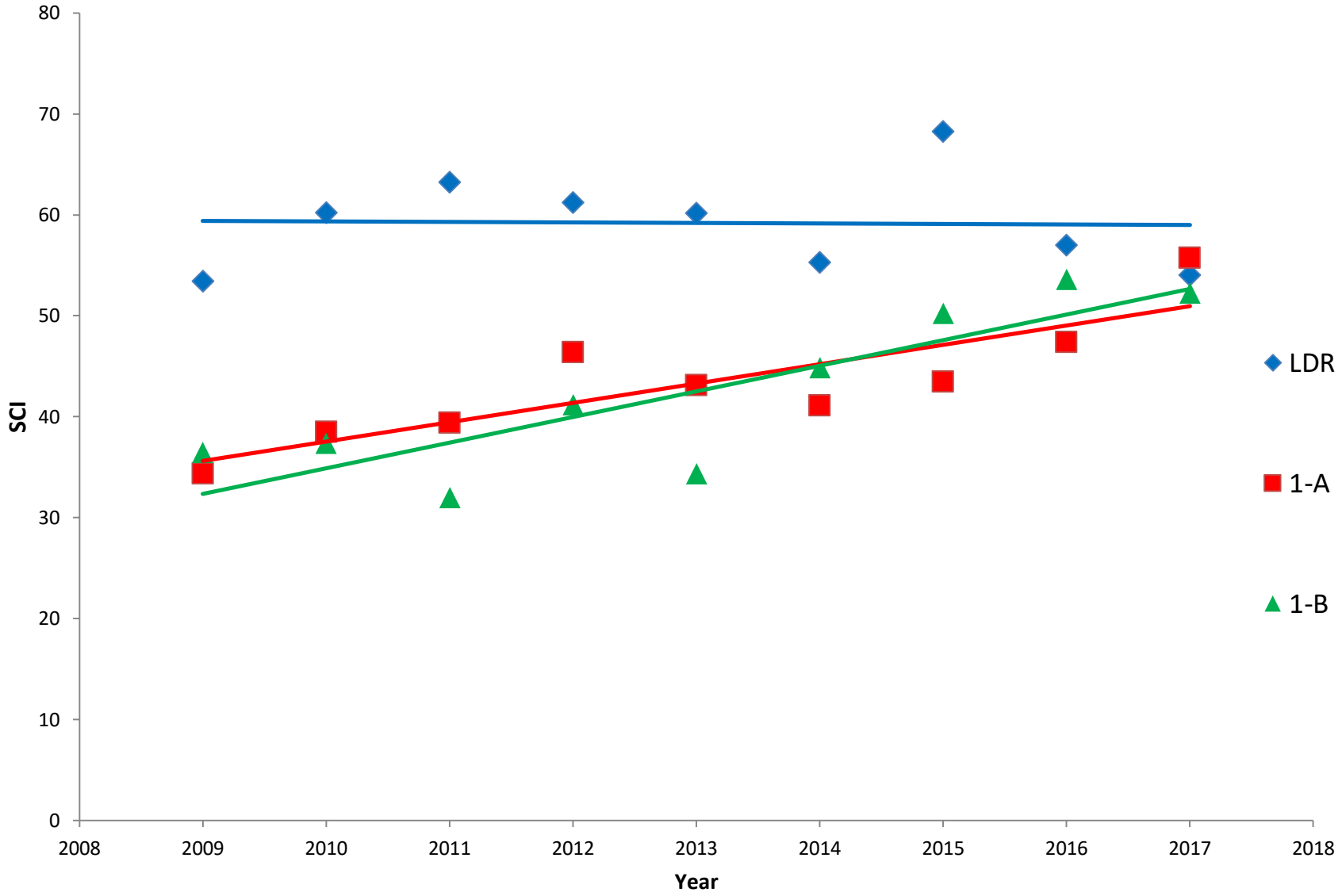
2017

The Invertebrate Story

- Field of Dreams? Wetland Studies Built It – Did They Come?

- Both Habitat and Invertebrate condition scores show gradual improvement, with Snakeden Branch condition converging toward the condition of Little Difficult Run

Invertebrates: Virginia DEQ Stream Condition Index (SCI)



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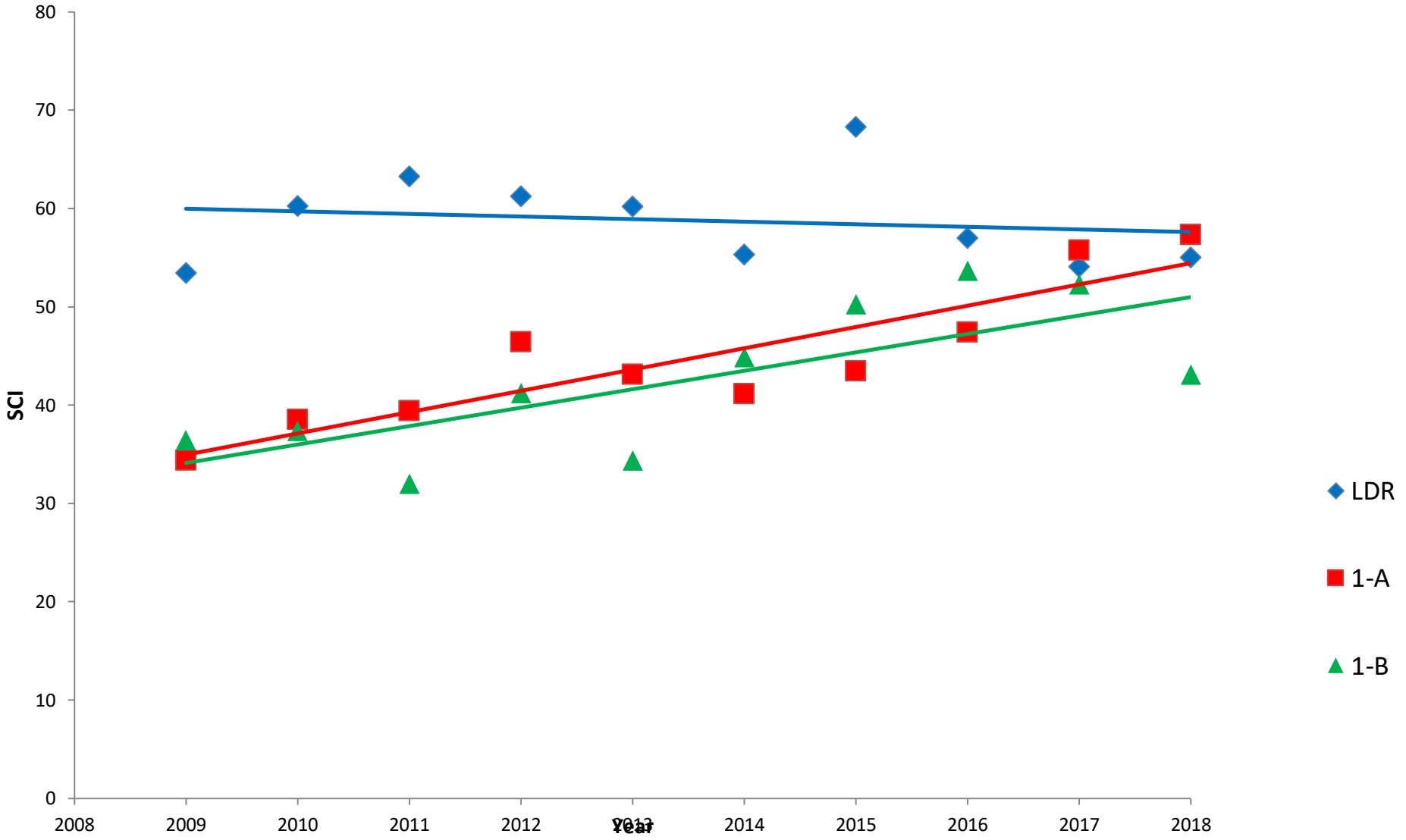

The 2018 Story - 1

- Temperature:
  - Snakeden temperatures continue to be more similar to Little Difficult Run in recent years than they were at the beginning of the study.
  - January minimum temperatures are now nearly identical between the two streams, but July maximum temperatures in Snakeden have been higher than Little Difficult the past 2 years
  - The diel range in January has been similar between the 2 streams throughout the study, but the diel range in July has gradually declined in Snakeden and become more similar to Little Difficult Run
  - A possible reason for the higher July maximum temperatures in Snakeden for 2017 and 2018 (compared to Little Difficult Run) is the decrease in canopy cover (more open canopy) due to dieback of the riparian willows.

- Habitat:
  - Both reaches have shown improvement over the years but appear to have peaked
  - Snakeden 1-B has been more variable – started more poorly but has improved more than 1-A

The 2018 Story

- Invertebrates:
  - Pattern of increasing SCI scores in Snakeden (approaching the scores in Little Difficult Run) continued in 2018, according to the trendline
  - Reach 1-A had a higher SCI score in 2018 than in 2017, but Reach 1-B was lower
  - Fewer specimens were collected in 2018 than in 2017. This seems most likely due to the wet summer and fall conditions, with frequent high (but not catastrophic/scouring) flows.

Invertebrate Observations

- Increases in 1-A (relative to 1-B or LDR) in Oligochaeta, Physidae, Elmidae, Tipulidae, Chironomidae – do these suggest organic enrichment?
- Heptageniidae recently found in Snakeden 1-A
- Corbicula found in 1-B in 2017 – becoming common in Lake Audubon?
- Phryganeidae found recently in the Glade – possible colonizer from habitubes??
- Taxa found in Little Difficult Run but not yet found in Snakeden post-restoration: Leuctridae (Plecoptera), Ephemerellidae (Ephemeroptera), Psychomyiidae (Trichoptera), Cordulegastridae (Odonata), Amphipoda, Isopoda

Topics A-Plenty for Discussion

- How do our findings compare with those of WSSI? Are there differences due to season (life cycles, flow, temperature, golf course management, Kids' Trout Fishing Day)? What is WSSI learning from other restored Reston streams?
- What factors limit the colonization of Snakeden Branch by new taxa?
  - No unrestored upstream reaches
  - Lake Audubon downstream inhibits upstream migration of colonizers
  - Lack of high-quality streams nearby
  - Potential effects of Kids' Trout Fishing Day (fish predation)
  - Stream chemistry?

More Topics!

- Why are we seeing differences in reaches 1-A and 1-B for habitat and some taxa?
  - Golf course / tributary effects?
  - More sediment deposition in 1-A due to proximity of lake?
  - Any differences in restoration methods?
- What happened during 2012-2014?
- Are lesser(?) willow sawflies having an effect on habitat?
- Habitubes: good or bad habit? Where have they been installed besides 1-A and 1-B? Any future plans?
- “Story” for RASER 2018 (Reston Annual State of the Environment Report; www.reston.org)

Do We Move Forward?

- What have been the main benefits of this study?
  - Student experience; participation in scientific data collection
  - Data available to contribute to public information needs (answer questions that were raised during hearings prior to restoration); now part of RASER
  - Demonstration that Citizen Science can produce valuable data
- Other potential benefits:
  - Contribution to the scientific community and the field of restoration ecology
  - Potential use by Virginia DEQ in their database (but this would require submitting a QAPP with a quality assurance review of the methods, identifications, and data)
- Potential to involve other partners, e.g., Fairfax County, Northern Virginia Soil & Water Conservation District

How Do We Move Forward?

- Discuss Responsibilities for:
  - Overall Coordination
  - Habitat
  - Chemistry
  - Invertebrates
  - Temperature
  - “Outreach” – Sharing of results, involving other entities?

Overall Coordination

- Ensure that there are leaders (and backups) foe each component: Invertebrates, Habitat, Chemistry, Temperature
- Schedule sampling dates, backup dates, and any planning meetings, reach recon/marking, etc.
- Make go/no go decisions for sampling (and rescheduling) in the event of adverse weather and/or flow conditions, personnel availability, government shutdowns, etc.
- Coordinate data analysis and discussion as needed
- Ensure data storage and data backups are done regularly, including scanning and storing field data sheets and invertebrate ID sheets

Invertebrates

- Ensure sampling gear is available and ready to use for annual invertebrate sampling and invertebrate sample processing (ID)
- Demonstrate and lead collection of invertebrate samples by SLHS students using the VA-DEQ protocol
- Lead the sample processing session; ensure that a qualified person is available to verify identifications to appropriate taxonomic levels
- Enter the ID data into existing spreadsheets for calculating the Stream Condition Index (SCI)
- Periodically review/plot/analyze data (or prepare data in a format that can be given to someone else)
- Prepare a summary of the collections as required for the annual collection permit report

Temperature

- Ensure appropriate gear is available and ready to use for downloading data from HoboTemp temperature data loggers – this is done at least annually
- Test data loggers in an ice bath before downloads in case one or more loggers are lost or have dead batteries (note: we have plenty)
- Visit field sites after extreme high-flow events or low-flow periods to ensure loggers are still in place and under water (replace with new loggers if necessary)
- Download temperature data at least annually (and replace loggers as needed)
- Manipulate data for calculating and graphing temperature statistics such as seasonal average, maximum, and minimum daily averages for each data logger and for each stream

Marty's role ???

- Assist in the transition for coordination, invertebrates, and temperature
- Assist in these activities as available
- Cheer on everyone else involved in this study!