



Peace River Monitoring Program 2012-2019

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Outline

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- 02 Summary of Water Quantity Results

- 03 Summary of Water Quality Results

- 04 Summary of Biological Results

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PRMP Program Summary

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PRMP Program Summary

- > Peace River Monitoring Program (PRMP) formed as part of a settlement agreement in 2012 between Mosaic and the Sierra Club, Manasota-88, and the People for Protecting the Peace River
- > Goal of the program is to ensure that mining activities at the South Fort Meade Hardee County Mine are having no significant downstream impacts
- > Area of study is in the Peace River and tributaries between Fort Meade and Wauchula (Upper Peace River Basin)
- > The program has three components
 - Monitoring and reporting on water quantity
 - Monitoring and reporting on stream quality
 - Monitoring and reporting on stream biology

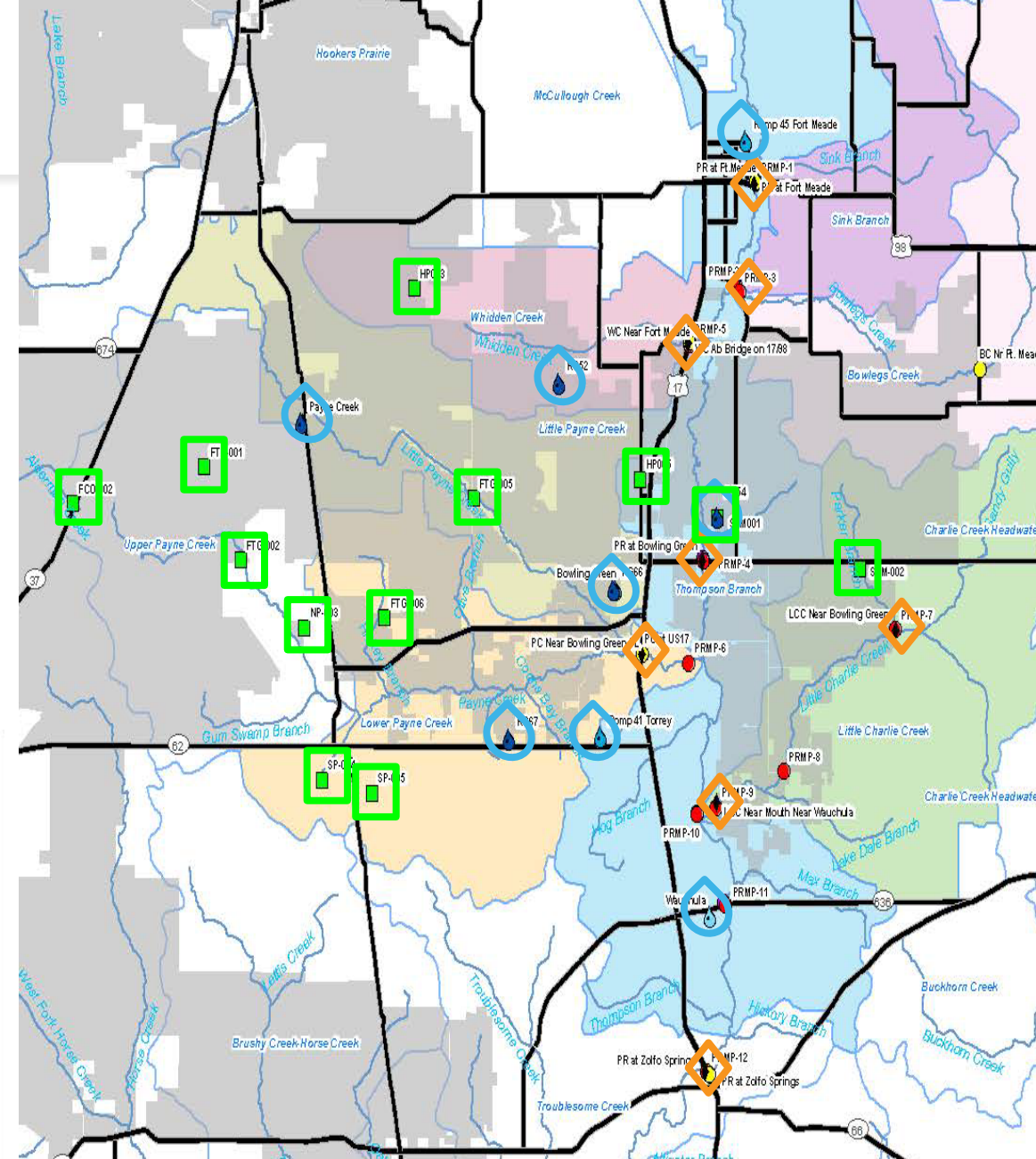


Water Quantity Monitoring

- ◇ Stream gauge height and streamflow monitored continuously at 3 locations on the Peace River, 2 locations on Little Charlie Creek, Payne Creek, Bowlegs Creek, and Whidden Creek
- 💧 Rainfall data monitored continuously at Mosaic gauges, SWFWMD gauges, and a NOAA gauge
- NPDES outfall discharge quantities monitored continuously at 5 Mosaic Mine facilities



ological	Mosaic Property
Quality	Bowlegs Creek
Water Quality	Little Charlie Creek
nd Gauge	Little Payne Creek
Quantity	Lower Payne Creek
Quantity	Peace River
ainfall	Sink Branch
all	Whidden Creek

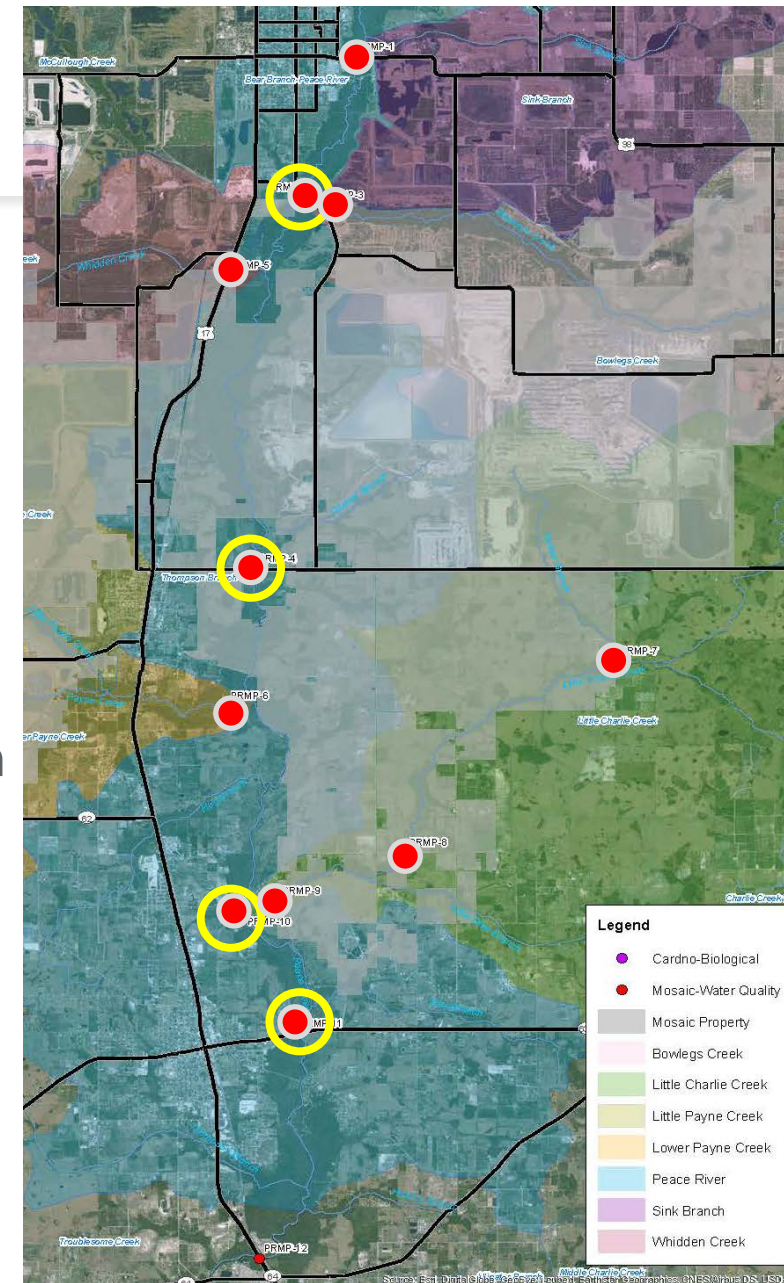


Water Quality Monitoring Parameters

Category	Parameter
Physio-Chemical	pH
	Dissolved Oxygen
	Temperature
	Turbidity
	Color
Nutrients	Total Nitrogen
	Total Kjeldahl Nitrogen
	Nitrate-Nitrite Nitrogen
	Total Ammonia Nitrogen
	Unionized Ammonia
	Orthophosphate
	Total Phosphorus
	Chlorophyll a
Dissolved Minerals	Specific Conductivity
	Dissolved Calcium
	Dissolved Magnesium
	Total Alkalinity
	Chloride
	Fluoride
	Sulfate
	Total Dissolved Solids
	Total Suspended Solids
Radiologicals	Total Radium (Radium 226+228)

Water Quality and Biological Monitoring

- > 11 Water Quality stations monitored monthly by Mosaic
 - 5 Locations in the Peace River
 - 3 Locations in Little Charlie Creek
 - 3 Tributaries (Bowlegs Creek, Whidden Creek, and Payne Creek)
 - Field parameters, nutrients, ions/minerals, and radium 226/228
- > 4 Biological stations in the Peace River monitored semi-annually by Cardno (dry season and wet season/immediately following when conditions meet SOP)
 - Stream Condition Index (SCI) and Habitat Assessments Performed
 - Fish sample collection via two different methods
 - Backpack Electrofishing
 - Small seine hauls



Annual Report – Water Quality and Quantity

- > Submitted by February 15th of the subsequent year
- > Graphically summarizes the current years rainfall, streamflow, stream gauge heights, and NPDES outfall discharge for water quantity
 - Cumulative summary tables for rainfall; P10/P50/P90 streamflow; correlation analysis between rainfall and streamflow and NPDES discharge and rainfall and streamflow
- > Graphically summarizes the current years water quality results at all stations for all parameters
 - Compares to Class III Surface Water Standards where applicable
 - Period of record data analysis for the Peace River and Little Charlie Creek stations (ANOVA)
 - Correlation analysis between water quality and quantity parameters (Spearman's Rank Correlations)



Annual Report – Benthic Macroinvertebrates and Fish

- > Photographic summary of current years sampling stations during each event and narrative summary of changes and sampling conditions
- > Tabular summary of SCI and Habitat Assessments for current year for each of the 4 stations
 - Graphical summary of total habitat assessment scores, total macroinvertebrate taxa, and SCI score over time
 - Statistical analysis to determine if there are differences among stations in SCI scores and total taxa observed
- > Tabular summary current years fish species collected per event and sampling method for all stations
 - Graphical summary of total individuals and total taxa caught at each station over time
 - Graphical summary of individual station diversity over time and cumulative diversity by station
 - Morisita's similarity index results and species accumulation curve





Summary of Water Quantity Results

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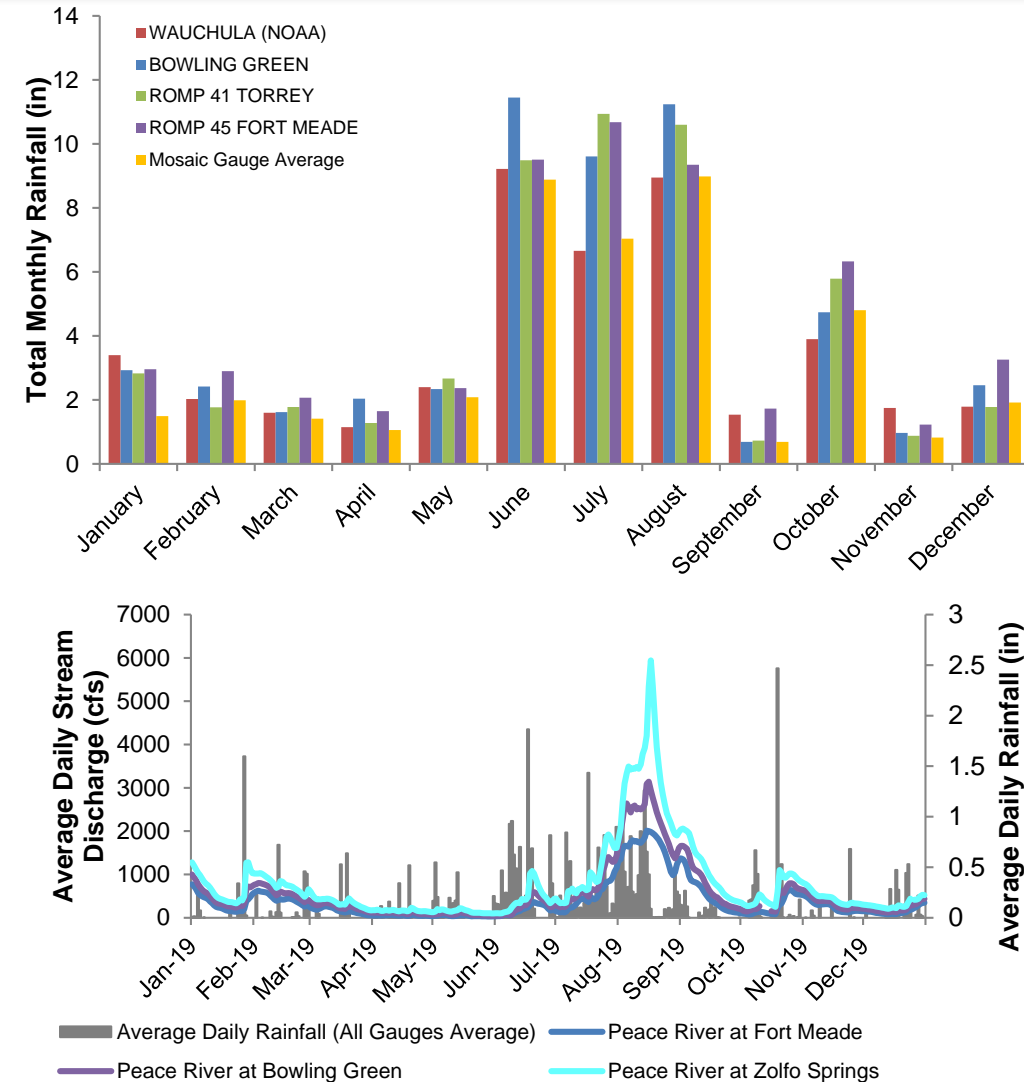
Water Quantity Summary – Rainfall and Streamflow

> 2019 Rainfall

- Heaviest rainfall observed from June to August and October
- September rainfall was atypically low

> 2019 Streamflow

- Similar to historical patterns with highest flows during wet season months of mid-July through mid-September
- Smaller peaks in flows in early January, February, mid-June, and mid-October
- 10th, 50th, and 90th percentile flows were higher than the historical averages at all Peace River Stations (PRMP-1, PRMP-4, and PRMP-12) along with Whidden Creek and Payne Creek



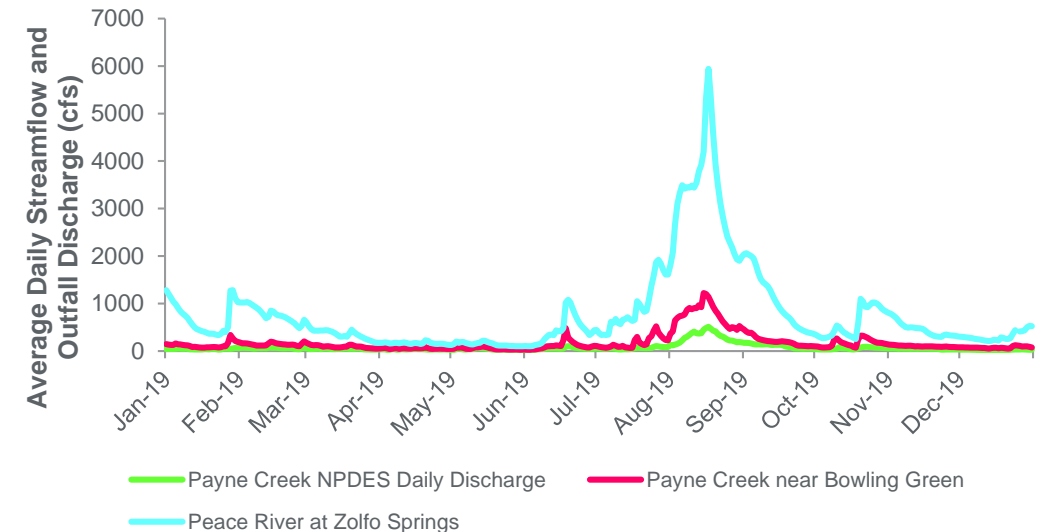
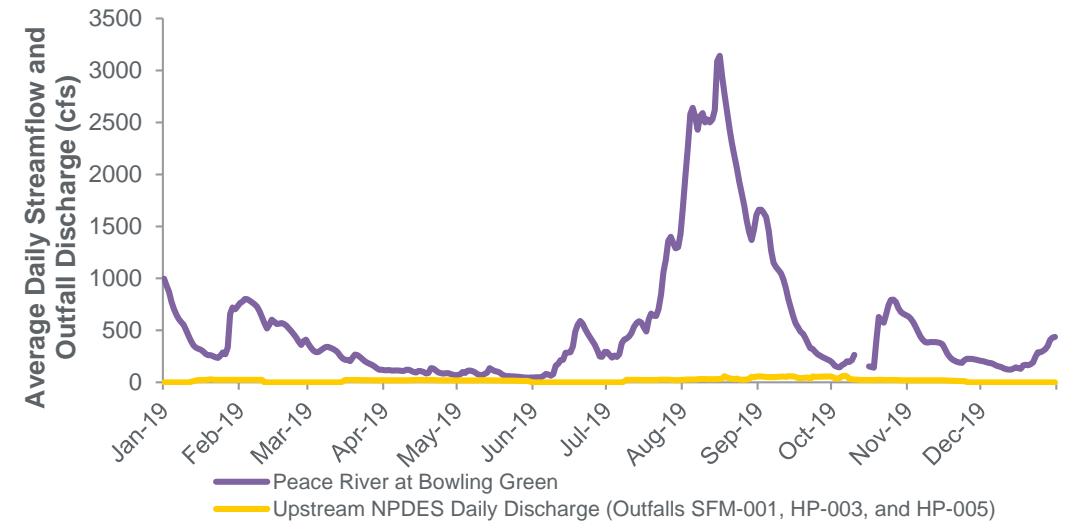
Water Quantity Summary – NPDES Discharge and Correlations

> 2019 NPDES Discharge

- Upstream NPDES outfalls potentially account for 7% daily streamflow in the Peace River at County Line Rd (PRMP-4)
- Payne Creek NPDES outfalls could account for an average of 12% of daily streamflow

> Correlations

- From 2012-2019 streamflow and rainfall were positively correlated, as expected
- NPDES discharge positively correlated with streamflow and stage height at Peace River and tributary stations
 - This was regardless of whether outfalls located upstream, downstream, or on different tributaries
 - **NPDES discharge does not change pattern of flow in Peace River downstream of outfalls**



Summary of Water Quality Results

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Water Quality Summary

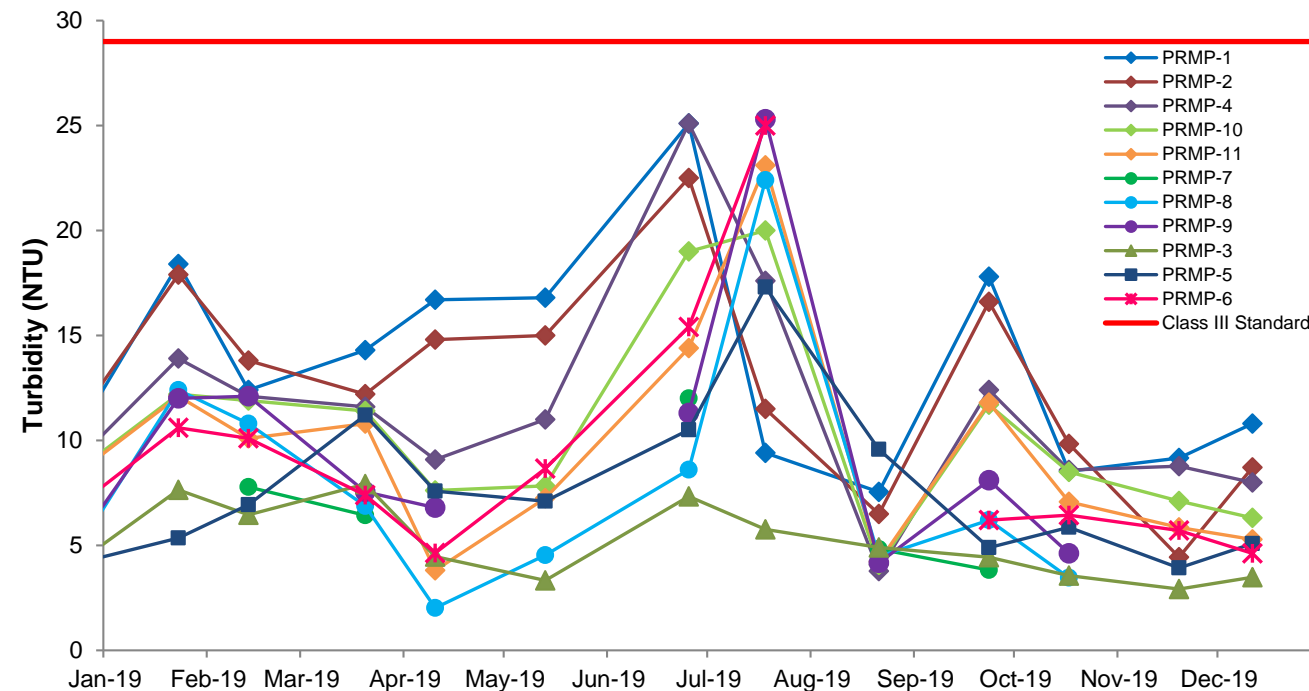
- > **There were no exceedances of Class III Water Quality Standards in the Peace River in 2019**
- > There were generally significant differences among Peace River and Little Charlie Creek stations over time (Analysis of Variance-ANOVA) – this varied by parameter
- > Spearman's Rank Correlation compared water quantity parameters (streamflow, rainfall, NPDES discharge) with water quality parameters where appropriate
 - 12 parameters had concentrations that decreased with increasing rainfall or streamflow
 - pH, DO saturation, nitrate-nitrite, unionized ammonia, SC, calcium, magnesium, alkalinity, chloride, fluoride, sulfate and TDS
 - 7 parameters had concentrations that increased with increasing rainfall or streamflow
 - Water temperature, turbidity, color, TKN, ammonia, chlorophyll-a, and TSS

Water Quality Summary

- > Bowlegs Creek (PRMP-3) had the highest background total radium measurements compared to other PRMP monitoring stations (still below the Class III Standard of 5 pCi/L)
 - No current mining or NPDES discharges to that system – cause is unknown
- > Whidden Creek (PRMP-5) had the highest orthophosphate and TP concentrations year-round
 - Generally had lower concentrations during months when Mosaic's outfall was discharging NPDES discharge (HP-003)
- > Whidden Creek had the highest ion concentrations of all stations
 - SC, calcium, fluoride, sulfate, and TDS
 - Water quality influenced, at least temporarily, by closure of US Agri-Chem's (USAC) phospho-gypsum stack
 - No active mining by Mosaic currently within Whidden Creek

Water Quality Summary

- > Turbidity was elevated at all stations in June 2019 but still below the Class III Standard of 29 NTU above background
 - Sampling occurred after 12 days of rain with cumulative totals of 5.5 to 7.9 inches
 - There was also a month of discharge from Lake Hancock to supplement flows prior to the June sampling event

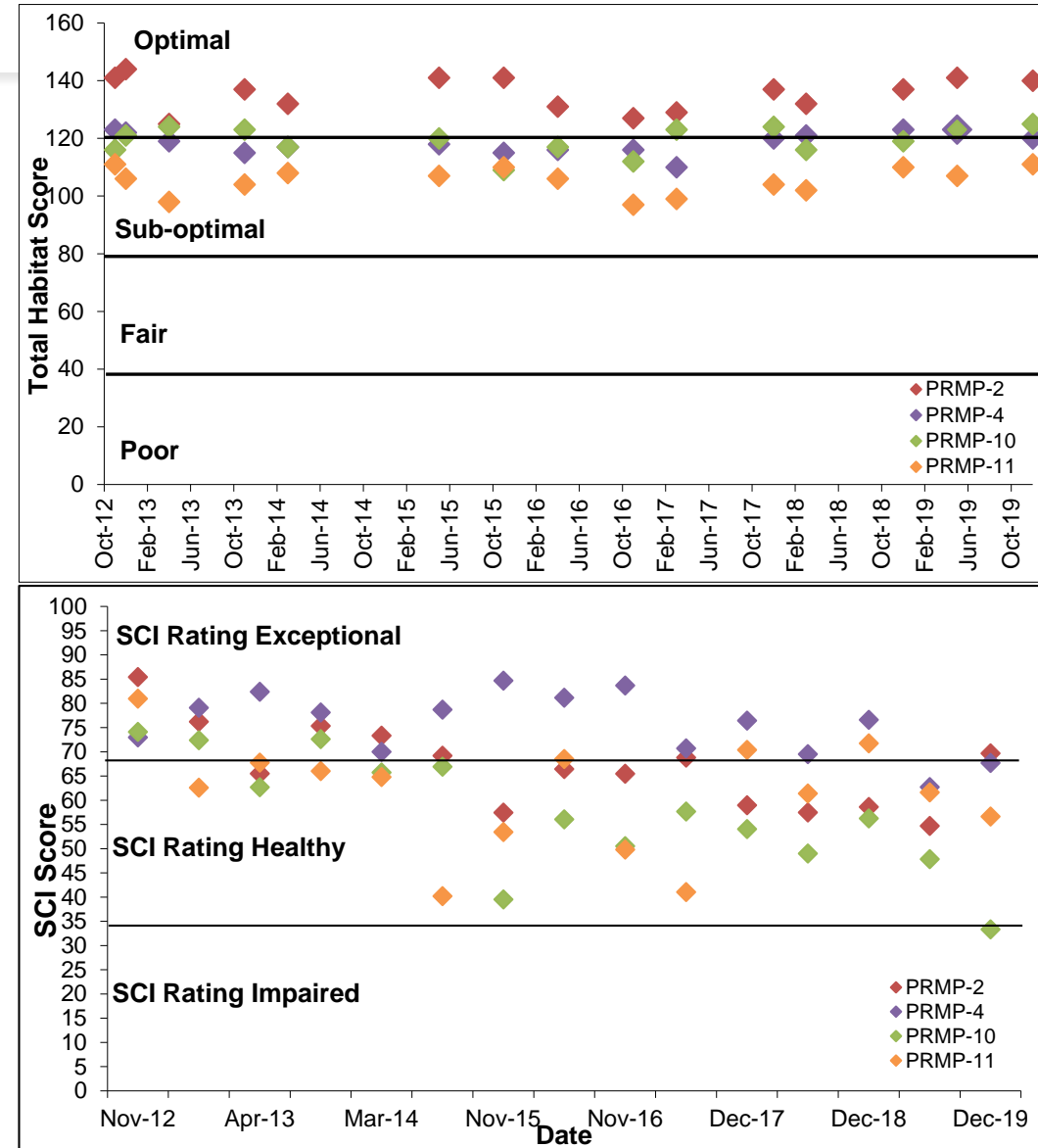


Summary of Biological Results

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Benthic Invertebrate Summary

- > Habitat Assessment scores have been in the Optimal or Sub-optimal categories for all stations since monitoring began
 - Differences in scores because of differences in width, depth, and flow between stations and habitat availability
- > All but one SCI score at one station have been considered “Healthy” from 2012-2019
 - Lower score at PRMP-10 in December 2019 resulted from the sample being dominated by a native serrate crownsnail species (over 100 of 150 invertebrates picked for analysis)
 - **PRMP-4 (closest to SFM-001 NPDES outfall) has always had passing SCI scores**
 - For most events, it has had the **highest** SCI score



Fish Species Summary

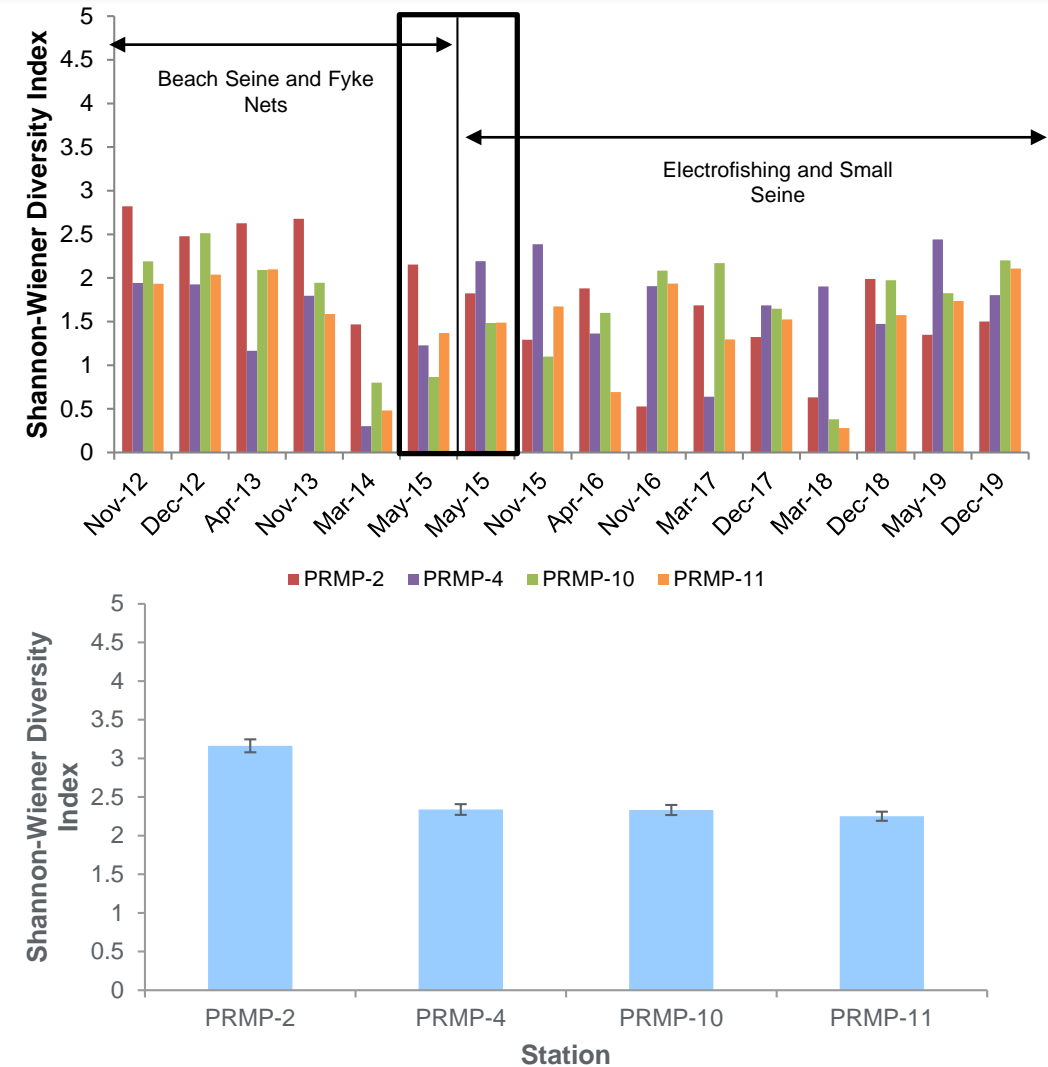
- > 560 fish representing 12 families and 18 species were collected by backpack electrofishing and small seining in 2019
 - 3 invasive/exotic species collected
 - Asian swamp eel, blue tilapia, vermiculated sailfin catfish
- > Most abundant species caught were coastal shiners (26.3%), eastern mosquitofish (25.7%), and golden silversides (21.8%)
- > A total of 36 species have been caught in the Upper Peace River from 2012-2019



Common Name	Scientific Name	PRMP-2		PRMP-4		PRMP-10		PRMP-11	
		May-19	Dec-19	May-19	Dec-19	May-19	Dec-19	May-19	Dec-19
Asian swamp eel*	<i>Monopterus albus</i>	2		1	1	2	2	1	
Blue tilapia*	<i>Oreochromis aureus</i>							1	
Bluegill	<i>Lepomis macrochirus</i>			2				2	3
Channel catfish	<i>Ictalurus punctatus</i>							1	
Coastal shiner	<i>Notropis petersoni</i>		6	6	93	3	8	2	29
Eastern mosquitofish	<i>Gambusia holbrooki</i>	1	21	7	22	39	12	25	17
Florida gar	<i>Lepisosteus platyrhincus</i>				1				
Golden silverside	<i>Labidesthes vanhyningi</i>	5			90			3	24
Hogchoker	<i>Trinectes maculatus</i>		2		10		4		
Ironcolor shiner	<i>Notropis chalybaeus</i>						2		
Largemouth bass	<i>Micropterus salmoides</i>					1			
Redear sunfish	<i>Lepomis microlophus</i>	1		2		6		1	1
Sailfin molly	<i>Poecilia latipinna</i>					4			
Seminole killifish	<i>Fundulus seminolis</i>			1	1				1
Spotted sunfish	<i>Lepomis punctatus</i>	13	17	11	8	7	9	4	13
Swamp darter	<i>Etheostoma fusiforme</i>					1			
Vermiculated sailfin catfish*	<i>Pterygoplichthys disjunctivus</i>			5		1	1		
Warmouth	<i>Lepomis gulosus</i>			1					
Total Taxa		5	4	9	8	9	7	9	7
Total Individuals		22	46	36	226	64	38	40	88

Fish Diversity Summary

- > Fish diversity measured with Shannon-Wiener Diversity Index
 - Since methodology change in May 2015, fish diversity has ranged from 0.28 to 2.44
- > May 2019 fish diversity ranged from 1.35 to 2.44
- > December 2019 diversity ranged from 1.50 to 2.20
- > When sampling events combined by station, PRMP-2 had slightly higher species diversity (3.16) than other three downstream stations (2.25 to 2.34)
 - **Species diversity between stations are not significantly different**



Conclusions

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Conclusions

- > While there are multiple Mosaic NPDES outfalls in the Upper Peace River Basin, they only accounted for up to 12% of the overall streamflow in the Peace River in 2019
 - **NPDES discharge does not change pattern of flow in Peace River downstream of the outfalls**
 - At present, there is no reason to expect any change to water quality as a result of mining activities in the PRMP study area
- > **There were no exceedances of Class III Water Quality Standards in the Peace River in 2019**
- > Stable and healthy Habitat Assessment and SCI scores at the four Peace River stations do not indicate negative impacts from mining or associated activities from 2012-2019
 - **PRMP-4 (closest to SFM-001 NPDES outfall) has always had passing SCI scores**
 - For most events, it has had the **highest** SCI score
- > Fish species diversity between stations are not significantly different
 - The similarity of fish community structure along the Peace River was generally high and was a function of distance between station pairs, unrelated to mining

QUESTIONS?





Thank you

For more information

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