Appendix D:
Field Sheets

Reach Characteristics Key

Table 1 Land Use

1. Forest
2. Pasture
3. Agricultural
4. Industrial
5. Park
6. Institutional
7. Residential
8. Golf Course
9. Commercial

Table 2 Valley Type

1. Unconfined
2. Confined
3. Partially Confined

Table 3 Channel Type

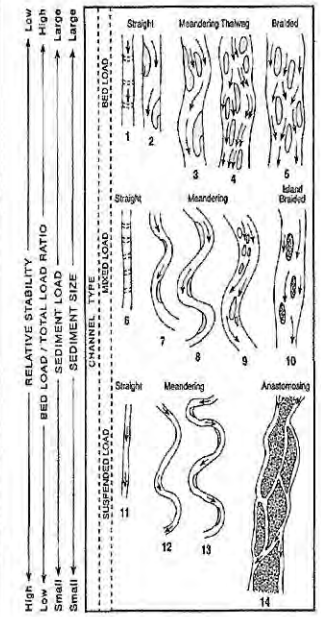


Table 4 Channel Zone

1. Headwater zone
2. Transfer zone
3. Deposition zone

Table 5 Flow Type

1. Perennial
2. Intermittent
3. Ephemeral

Table 6 Dominant Vegetation Type

1. Trees
2. Shrubs
3. Grasses
4. Herbaceous

Table 7 Extent of Encroachment into Channel

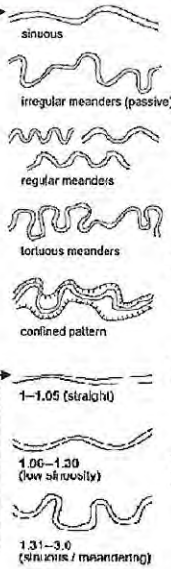
1. None
2. Minimal
3. Moderate
4. Heavy
5. Extreme

Table 8 Type of Aquatic Vegetation

1. Rooted Emergent
2. Rooted Submergent
3. Rooted Floating
4. Free Floating Roots
5. Floating Algae
6. Attached Algae

Table 9 Type of Sinuosity

1. Sinuous
2. Irregular Meanders
3. Regular Meanders
4. Tortuous Meanders
5. Confined pattern (within valley)



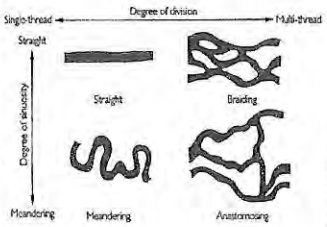


Table 10 Degree of Sinuosity

1. Straight (1 – 1.05)
2. Low sinuosity (1.06–1.30)
3. Meandering (1.31 - 3.0)

Table 11 Gradient

1. Low
2. Moderate
3. High

Table 12 Number of Channels

1. Single
2. Up to 3 (Wandering)
3. >3 (Braided)
4. >3 (Anastamosing or Anabranching)
5. Discontinuous or Absent

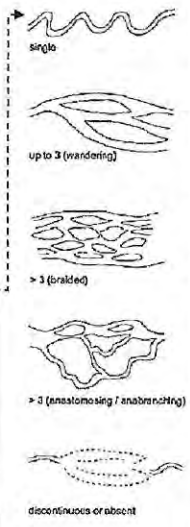
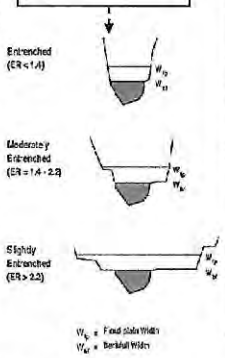


Table 13 Entrenchment

1. Low (>2.2)
2. Moderate (1.4 – 2.2)
3. High (<1.4)



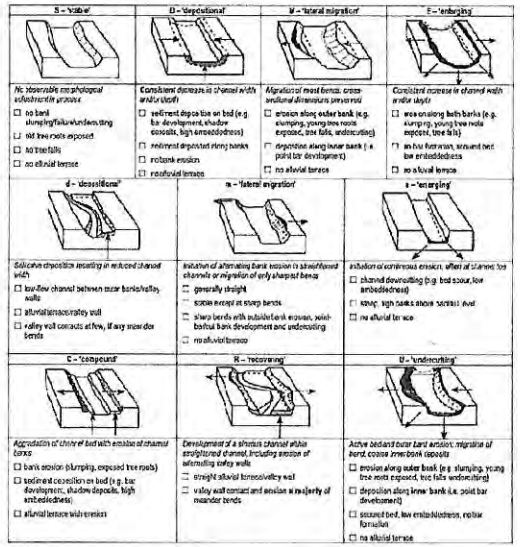


Table 14 Type of Bank Failure

1. Fluvial Entrainment (Hydraulic action)
2. Undercutting (Hydraulic action)
3. Slab Failure (Mass failure)
4. Parallel slide (Mass failure)
5. Fall/Sloughing (Mass failure)
6. Rotational slip and slump (Mass failure)

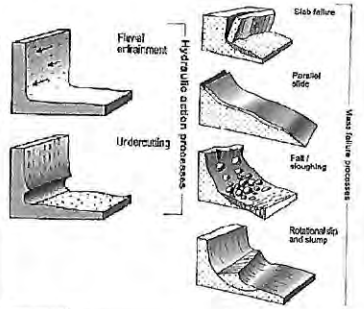


Table 15 Downs's Model of Channel Classification

S – Stable
D or d – Depositional
M or m – Lateral Migration
E or e – Enlarging
C – Compound
R – Recovering
U – Undercutting

Table 16 Odours

1. None
2. Fishy
3. Petroleum
4. Sewage
5. Chemical
6. Other

Table 17 Turbidity

1. Clear
2. Slightly turbid
3. Turbid
4. Opaque
5. Stained
6. Other

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code: 19097

Date:	July 22, 2020	**Stream/Reach:**	R2 - BB
Weather:	25°C sunny	**Location:**	Sunnybrook
Field Staff:	BM.	**Watershed/Subwatershed:**	Burke Brook (Don R)
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 1/5 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 8 | **Channel Zone** (Table 4): 3 | **Flow Type** (Table 5): 1 | ☐ Groundwater | Evidence: _____

Riparian Vegetation

Dominant Type: (Table 6): 1
Species: _____

Coverage:
- ☐ None
- ☐ Fragmented
- ☑ Continuous

Channel widths:
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs):
- ☐ Immature (<5)
- ☑ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 1

Aquatic/Instream Vegetation

Type (Table8): 6 | Coverage of Reach (%): 0-5

Woody Debris
- ☐ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☑ Moderate
- ☐ High

WDJ/50m: 1

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 2

Channel Characteristics

Sinuosity (Type) (Table 9): 3 | **Sinuosity (Degree)** (Table 10): 3 | **Gradient** (Table 11): 2 | **Number of Channels** (Table 12): 1

Entrenchment (Table 13): 2 | **Type of Bank Failure** (Table 14): 2 | **Downs's Classification** (Table 15): D

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☑	☑	☑	☑	☐	☐
Pool Substrate	☐	☑	☑	☑	☐	☐	☐
Bank Material	☑	☑	☐	☐	☐	☑	☑

Bankfull Width (m)	6.9	11.2		**Wetted Width (m)**	5.1	6.2	
Bankfull Depth (m)	1.2	1.5		**Wetted Depth (m)**	0.15	0.10	

Riffle/Pool Spacing (m): 20 | **% Riffles:** 40 | **% Pools:** 40 | **Meander Amplitude:** 29

Pool Depth (m): 0.30 | **Riffle Length (m):** 20 | **Undercuts (m):** 0.3 | **Comments:**

Velocity (m/s): 0.4 | 0.2 | | Wiffle ball / ADV / Estimated

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☐ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☑ 30 – 60%
- ☐ 60 – 100%

Banks restored.

Erosion mitigation of select banks

Notes:

Completed by: BM. Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment **Project Code:** 19097

Date:	July 22, 2020	**Stream/Reach:**	R2 - B3
Weather:	25° Sunny	**Watershed/Subwatershed:**	Burke Bk (Don R)
Field Staff:	BM	**Location:**	Sunnybrook Park.

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars	✓		
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone	✓		
		Sum of indices =	4	3	0.57
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	✓		→ historically exposed...
	2	Exposed sanitary / storm sewer / pipeline / etc.		✓	
	3	Elevated storm sewer outfall(s)		✓	
	4	Undermined gabion baskets / concrete aprons / etc.	✓		
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	2	8	0.2
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots	✓		
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.		✓	
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		✓	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation N/A			
		Sum of indices =	2	7	0.22
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =	1	6	0.14

Additional notes:

Reach impacted by multiple erosion mitigation treatments. (URB's + grade controls). Historically (mid-2000's) exhibited indicators of degradation/widening/and Plan. adjustment.

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.28

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☑ 0.21 - 0.40	☐ 0.41

Completed by: BM Checked by: _____

Rapid Stream Assessment Technique

Project Code: 19097

Date:	July 22, 2020	**Stream/Reach:**	R2-3B
Weather:	25, sunny	**Location:**	Sawmybrook Pk
Field Staff:	BM.	**Watershed/Subwatershed:**	Bucke Brook (Don R)

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☒ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition >81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition <30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☒ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Date:	Jul 22, 2020	Reach:	DB R2	Project Code:	19097

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. • Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high amount of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ; ≥1.51:1	• Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
N/A	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☑ 5 ☐ 6	☐ 7 ☐ 8
Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15m below surface	• Objects visible to depth 0.15-0.5m below surface	• Objects visible to depth 0.5-1.0m below surface	• Objects visible to depth > 1.0m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☑ 5 ☐ 6	☐ 7 ☐ 8
Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: <50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: >80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☑ 5	☐ 6 ☐ 7

Total overall score (0–42) = 23	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)

"Fair", bordering on "good"

Completed by: BM Checked by: _____

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code: 19097

Date:	Jul 22, 2020	**Stream/Reach:**	BB-R3
Weather:	25° C sun	**Location:**	Sunnybrook
Field Staff:	BM.	**Watershed/Subwatershed:**	Burke Brook (Don R)
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 1/5 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): B | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☒ Groundwater | Evidence: Iron oxidation.

Riparian Vegetation

Dominant Type: (Table 6): 1
Species: \

Coverage:
- ☐ None
- ☐ Fragmented
- ☑ Continuous

Channel widths
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs):
- ☐ Immature (<5)
- ☑ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 1

Aquatic/Instream Vegetation

Type (Table8): 6 | **Coverage of Reach (%):** 0-5

Woody Debris
- ☐ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☐ Moderate
- ☑ High

WDJ/50m: 3

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 3

Channel Characteristics

Sinuosity (Type) (Table 9): 2
Sinuosity (Degree) (Table 10): 3
Gradient (Table 11): 2
Number of Channels (Table 12): 1
Entrenchment (Table 13): 3
Type of Bank Failure (Table 14): 2
Downs's Classification (Table 15): E/R

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☐	☑	☑	☑	☑	☐
Pool Substrate	☐	☑	☐	☐	☐	☐	☐
Bank Material	☑	☑	☐	☐	☐	☑	☑

Bankfull Width (m)	11.2	14.1		**Wetted Width (m)**	3.5	5.2	
Bankfull Depth (m)	1.4	1.3		**Wetted Depth (m)**	0.15	0.2	

Riffle/Pool Spacing (m): 40 | **% Riffles:** 65 | **% Pools:** 35 | **Meander Amplitude:** 22
Pool Depth (m): 0.35 | **Riffle Length (m):** 25 | **Undercuts (m):** 0.4 | **Comments:**
Velocity (m/s): 0.2 | 0.15 | | **Wiffle ball / ADV / Estimated**

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☐ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☑ 60 – 100%

Notes:
Channel widens
Inward degradation
more scouring, full
exposure moving US.

Completed by: BM Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment **Project Code:** 21047

Date:	Jul 22, 2020	**Stream/Reach:**	BB - R3
Weather:	25°C sun	**Watershed/Subwatershed:**	Burke BK (Don R)
Field Staff:	BM.	**Location:**	Sunnybrook PK

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars	✓		
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone		✓	
		Sum of indices =	3	4	0.43
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	NA		
	2	Exposed sanitary / storm sewer / pipeline / etc.	✓		
	3	Elevated storm sewer outfall(s)	NA		
	4	Undermined gabion baskets / concrete aprons / etc.	✓		
	5	Scour pools downstream of culverts / storm sewer outlets	NA		
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank	✓		
	10	Channel worn into undisturbed overburden / bedrock	✓		
		Sum of indices =	4	3	0.57
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots	✓		
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle	✓		
	6	Outflanked gabion baskets / concrete walls / etc. Manhole chimney	✓		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	✓		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	NA		
		Sum of indices =	5	4	0.55
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)			
	6	Thalweg alignment out of phase with meander form	✓		
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =	3	4	0.43

Additional notes:

↑ widening / degradation U/S

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.50

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☐ 0.21 - 0.40	☑ 0.41

Completed by: BM. Checked by: _____

Rapid Stream Assessment Technique

Project Code: 19097

Date:	July 22, 2020	**Stream/Reach:**	BB - R3
Weather:	25°C Sun	**Location:**	Sunnybrook Pk
Field Staff:	BM	**Watershed/Subwatershed:**	Burke Bk (Don R)

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☑ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition >81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition <30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4 .5	☐ 5 ☐ 6	☐ 7 ☐ 8

Date:	Jul 22, 2020	Reach:	R3 - BB	Project Code:	19097

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. • Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high amount of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ; ≥1.51:1	• Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4.5	☐ 5 ☐ 6	☐ 7 ☐ 8
Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15m below surface	• Objects visible to depth 0.15-0.5m below surface	• Objects visible to depth 0.5-1.0m below surface	• Objects visible to depth > 1.0m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☑ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8
Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: <50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: >80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☑ 5	☐ 6 ☐ 7

Total overall score (0–42) = 20	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)

Completed by: BM. Checked by: _____

GEO | MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code: 19097

Date:	July 22, 2020	**Stream/Reach:**	RM. - BB
Weather:	25°C Sunny	**Location:**	Sunnybrook Park
Field Staff:	BM.	**Watershed/Subwatershed:**	Burke Blk (Don R)
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 15 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 8 | **Channel Zone** (Table 4): 2 | **Flow Type** (Table 5): 1 | ☑ Groundwater | Evidence: low oxidation.

Riparian Vegetation

Dominant Type: (Table 6): 1
Species:

Coverage:
- ☐ None
- ☐ Fragmented
- ☑ Continuous

Channel widths
- ☐ 1-4
- ☑ 4-10
- ☐ > 10

Age Class (yrs):
- ☐ Immature (<5)
- ☑ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 1

Aquatic/Instream Vegetation

Type (Table8): 6 | Coverage of Reach (%): 0-5

Woody Debris
- ☐ Present in Cutbank
- ☑ Present in Channel
- ☐ Not Present

Density of WD:
- ☐ Low
- ☐ Moderate
- ☑ High

WDJ/50m: 3

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 2

Channel Characteristics

Sinuosity (Type) (Table 9): 2
Sinuosity (Degree) (Table 10): 3
Gradient (Table 11): 2
Number of Channels (Table 12): 1
Entrenchment (Table 13): 3
Type of Bank Failure (Table 14): 2
Downs's Classification (Table 15): E

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☐	☑	☑	☑	☑	☐
Pool Substrate	☐	☑	☑	☐	☑	☑	☐
Bank Material	☑	☑	☑	☐	☐	☑	☑

Bankfull Width (m)	13.7	14.5		**Wetted Width (m)**	6.1	4.3	
Bankfull Depth (m)	2.2	3.3		**Wetted Depth (m)**	0.10	0.05	

Riffle/Pool Spacing (m): 40 | **% Riffles:** 75 | **% Pools:** 25 | **Meander Amplitude:** 30
Pool Depth (m): 0.3 | **Riffle Length (m):** 35 | **Undercuts (m):** 0.5%
Velocity (m/s): 0.3 | 0.2 | Wiffle ball / ADV / Estimated

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☐ 60 – 90
- ☑ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☑ 60 – 100%

Comments:

Notes:
Increased degradation moving US. Hard fills exposed clay bed and banks.

Completed by: BM. Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment **Project Code:** 19097

Date:	July 22nd 2020	**Stream/Reach:**	R4 - BB.
Weather:	25°C Sunny	**Watershed/Subwatershed:**	Burke BK (Don R)
Field Staff:	BM.	**Location:**	Sunnybrook PK.

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars	✓		
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone		✓	
		Sum of indices =	2	5	0.29
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	✓	N/A	
	2	Exposed sanitary / storm sewer / pipeline / etc.	✓		
	3	Elevated storm sewer outfall(s)	✓		
	4	Undermined gabion baskets / concrete aprons / etc.	✓		
	5	Scour pools downstream of culverts / storm sewer outlets	✓		
	6	Cut face on bar forms		✓	
	7	Head cutting due to knickpoint migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank	✓		
	10	Channel worn into undisturbed overburden / bedrock	✓		
		Sum of indices =	6	3	0.67
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots	✓		
	4	Basal scour on inside meander bends	✓		
	5	Basal scour on both sides of channel through riffle	✓		
	6	Outflanked gabion baskets / concrete walls / etc.		✓	
	7	Length of basal scour >50% through subject reach	✓		
	8	Exposed length of previously buried pipe / cable / etc.	✓		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation		N/A	
		Sum of indices =	6	3	0.67
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form	✓		
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =	3	4	0.43

Additional notes:

↑ Widening / Degradation compared to R2, 3.

Select bends recently restored to protect San Pipe

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.52

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☐ 0.00 - 0.20	☐ 0.21 - 0.40	☑ 0.41

Completed by: BM. Checked by: _____

Rapid Stream Assessment Technique

Project Code: 19097

Date:	Jul 22, 2020	**Stream/Reach:**	RY - BB
Weather:	25°C sun	**Location:**	Sunnybrook PK
Field Staff:	BM.	**Watershed/Subwatershed:**	Burke BK (Don R)

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • >6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☑ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11
Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition >81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition <30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Date:	Jul 22, 2020	Reach:	R4 - BB	Project Code:	19092

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. • Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high amount of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ; ≥1.51:1	• Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☒ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8
Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15m below surface	• Objects visible to depth 0.15-0.5m below surface	• Objects visible to depth 0.5-1.0m below surface	• Objects visible to depth > 1.0m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☒ 4	☐ 5 ☐ 6	☐ 7 ☐ 8
Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: <50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: >80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☒ 5	☐ 6 ☐ 7

Total overall score (0–42) = 17	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)

Completed by: EM Checked by: _____