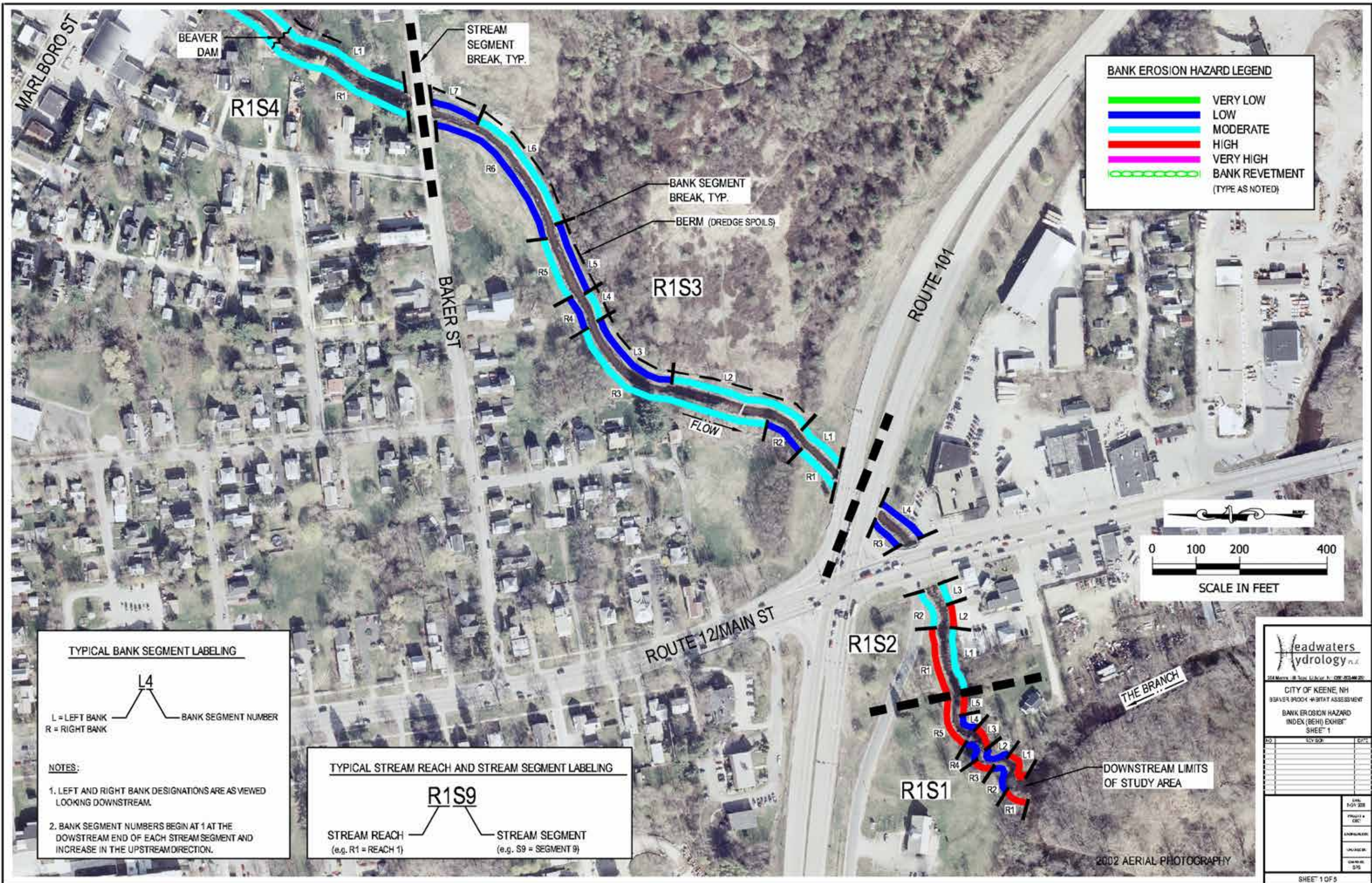
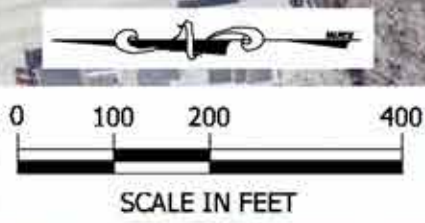


# **EXHIBIT 10**



**BANK EROSION HAZARD LEGEND**

- █ VERY LOW
- █ LOW
- █ MODERATE
- █ HIGH
- █ VERY HIGH
- ⊖ BANK REVETMENT (TYPE AS NOTED)



**TYPICAL BANK SEGMENT LABELING**

L = LEFT BANK  
R = RIGHT BANK

BANK SEGMENT NUMBER

**NOTES:**

- LEFT AND RIGHT BANK DESIGNATIONS ARE AS VIEWED LOOKING DOWNSTREAM.
- BANK SEGMENT NUMBERS BEGIN AT 1 AT THE DOWNSTREAM END OF EACH STREAM SEGMENT AND INCREASE IN THE UPSTREAM DIRECTION.

**TYPICAL STREAM REACH AND STREAM SEGMENT LABELING**

STREAM REACH (e.g. R1 = REACH 1)

STREAM SEGMENT (e.g. S9 = SEGMENT 9)

**Headwaters Hydrology, Inc.**

204 Main St., Keene, NH 03401-2000  
Tel: 603-351-1234 Fax: 603-351-1235

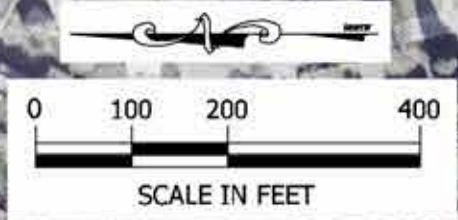
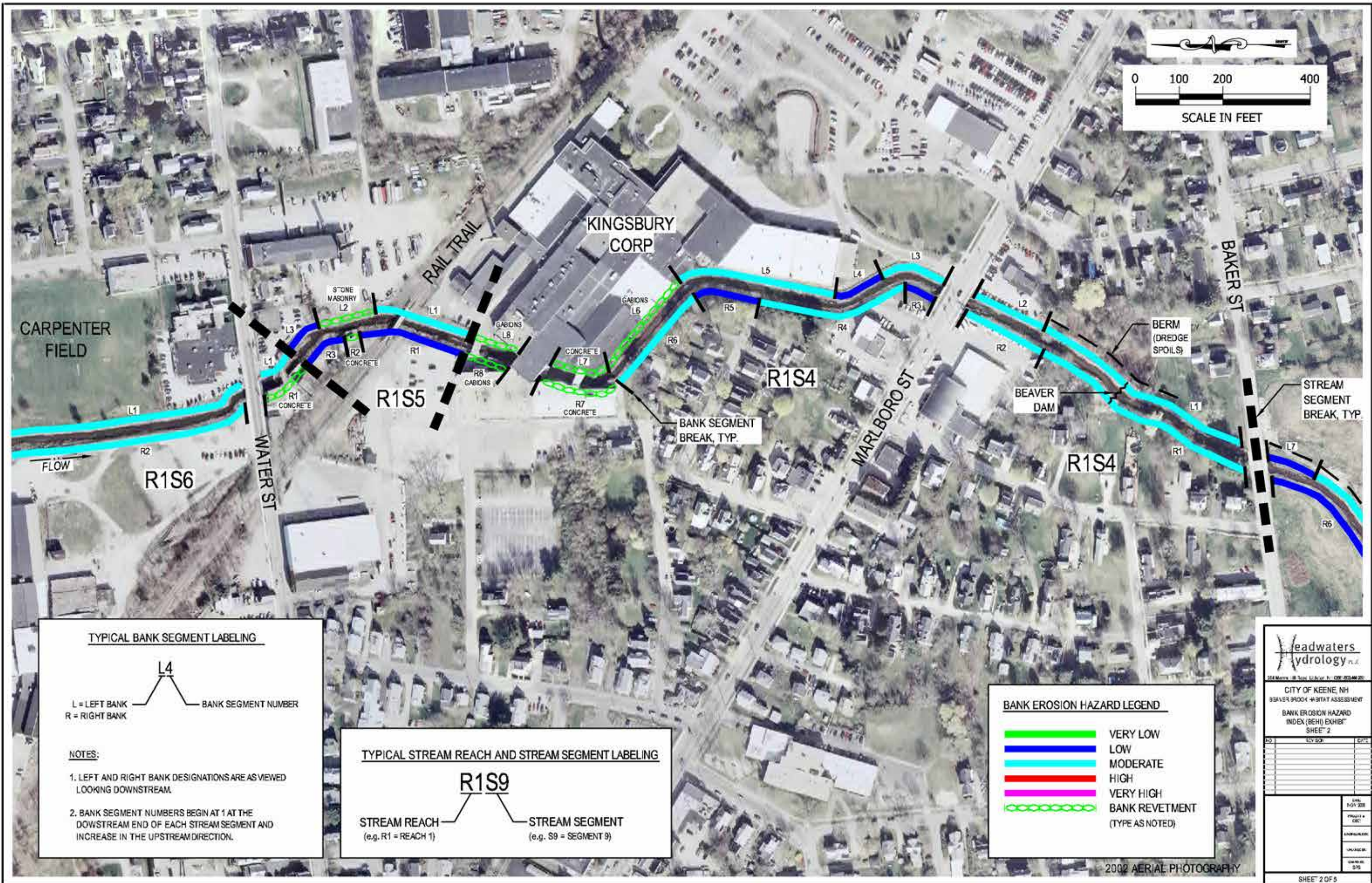
**CITY OF KEENE, NH**  
BEAVER BROOK HABITAT ASSESSMENT  
BANK EROSION HAZARD INDEX (BEHI) EXHIBIT SHEET 1

NO.	REVISED	DATE

DATE: 04/11/2008  
PROJECT: BEHI  
DRAWN BY: [blank]  
CHECKED BY: [blank]  
SCALE: 1"=100'

2002 AERIAL PHOTOGRAPHY

SHEET 1 OF 5



**TYPICAL BANK SEGMENT LABELING**

L4

L = LEFT BANK  
R = RIGHT BANK

BANK SEGMENT NUMBER

**NOTES:**

1. LEFT AND RIGHT BANK DESIGNATIONS ARE AS VIEWED LOOKING DOWNSTREAM.
2. BANK SEGMENT NUMBERS BEGIN AT 1 AT THE DOWNSTREAM END OF EACH STREAM SEGMENT AND INCREASE IN THE UPSTREAM DIRECTION.

**TYPICAL STREAM REACH AND STREAM SEGMENT LABELING**

R1S9

STREAM REACH (e.g. R1 = REACH 1)

STREAM SEGMENT (e.g. S9 = SEGMENT 9)

**BANK EROSION HAZARD LEGEND**

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH
- BANK REVETMENT (TYPE AS NOTED)

**Headwaters Hydrology, Inc.**

254 Main St., Keene, NH 03426-2020

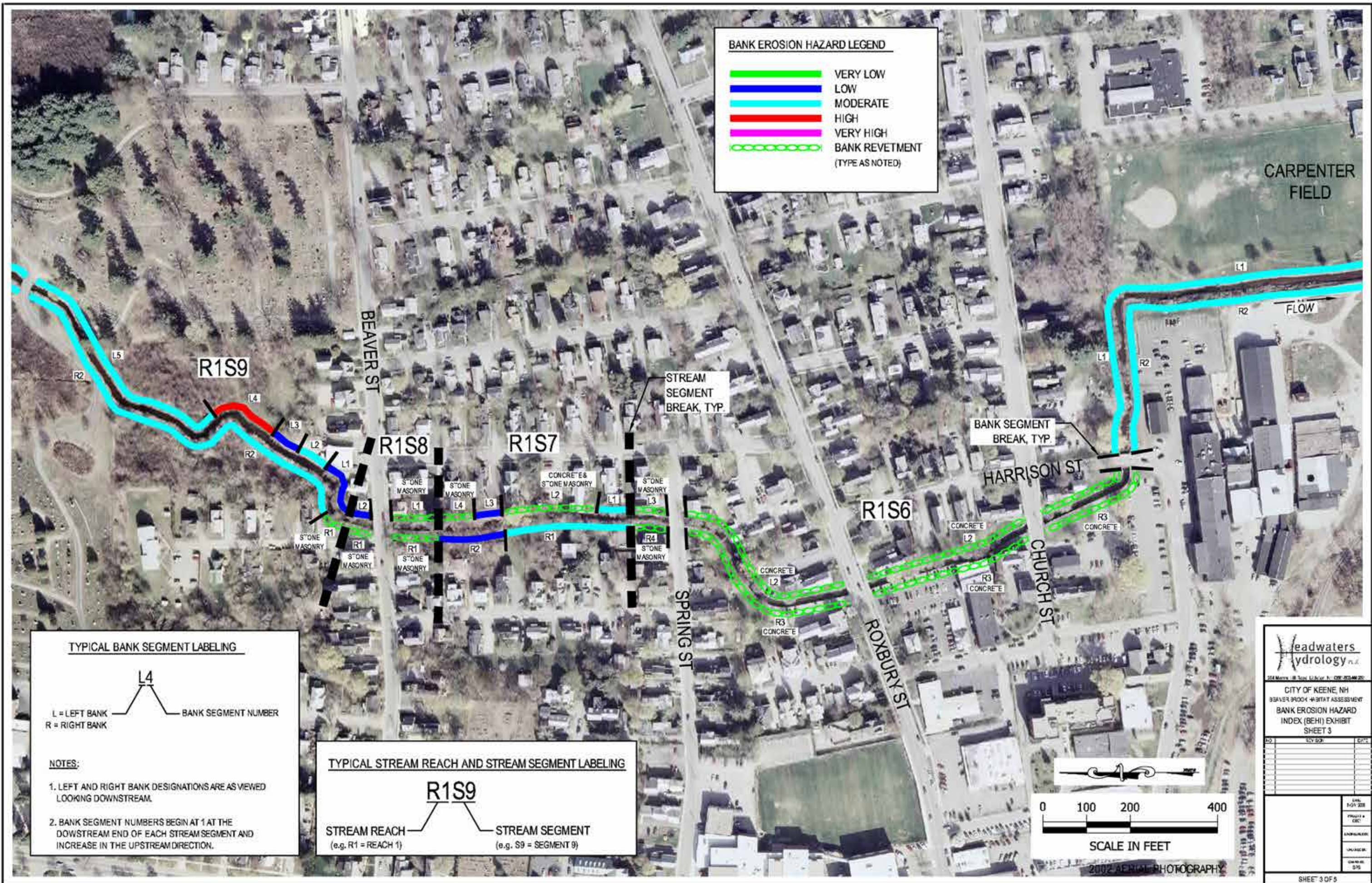
CITY OF KEENE, NH  
BEAVER BROOK HABITAT ASSESSMENT  
BANK EROSION HAZARD INDEX (BEHI) EXHIBIT SHEET 2

NO.	REVISED	DATE

DATE: 8/11/2011  
PROJECT: BEHI  
DRAWN BY: [Name]  
CHECKED BY: [Name]  
SCALE: 1"=50'

2002 AERIAL PHOTOGRAPHY

SHEET 2 OF 5



**BANK EROSION HAZARD LEGEND**

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH
- - - BANK REVETMENT (TYPE AS NOTED)

**TYPICAL BANK SEGMENT LABELING**

L = LEFT BANK  
R = RIGHT BANK

**NOTES:**

- LEFT AND RIGHT BANK DESIGNATIONS ARE AS VIEWED LOOKING DOWNSTREAM.
- BANK SEGMENT NUMBERS BEGIN AT 1 AT THE DOWNSTREAM END OF EACH STREAM SEGMENT AND INCREASE IN THE UPSTREAM DIRECTION.

**TYPICAL STREAM REACH AND STREAM SEGMENT LABELING**

STREAM REACH (e.g. R1 = REACH 1)

STREAM SEGMENT (e.g. S9 = SEGMENT 9)

**Headwaters Hydrology**

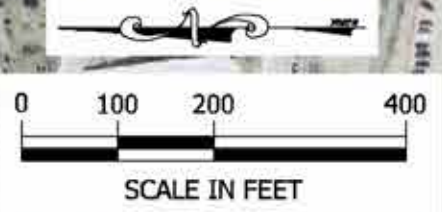
204 Main St., Keene, NH 03501-2000  
Tel: 603-351-1234

CITY OF KEENE, NH  
BEAVER BROOK HABITAT ASSESSMENT  
BANK EROSION HAZARD INDEX (BEHI) EXHIBIT SHEET 3

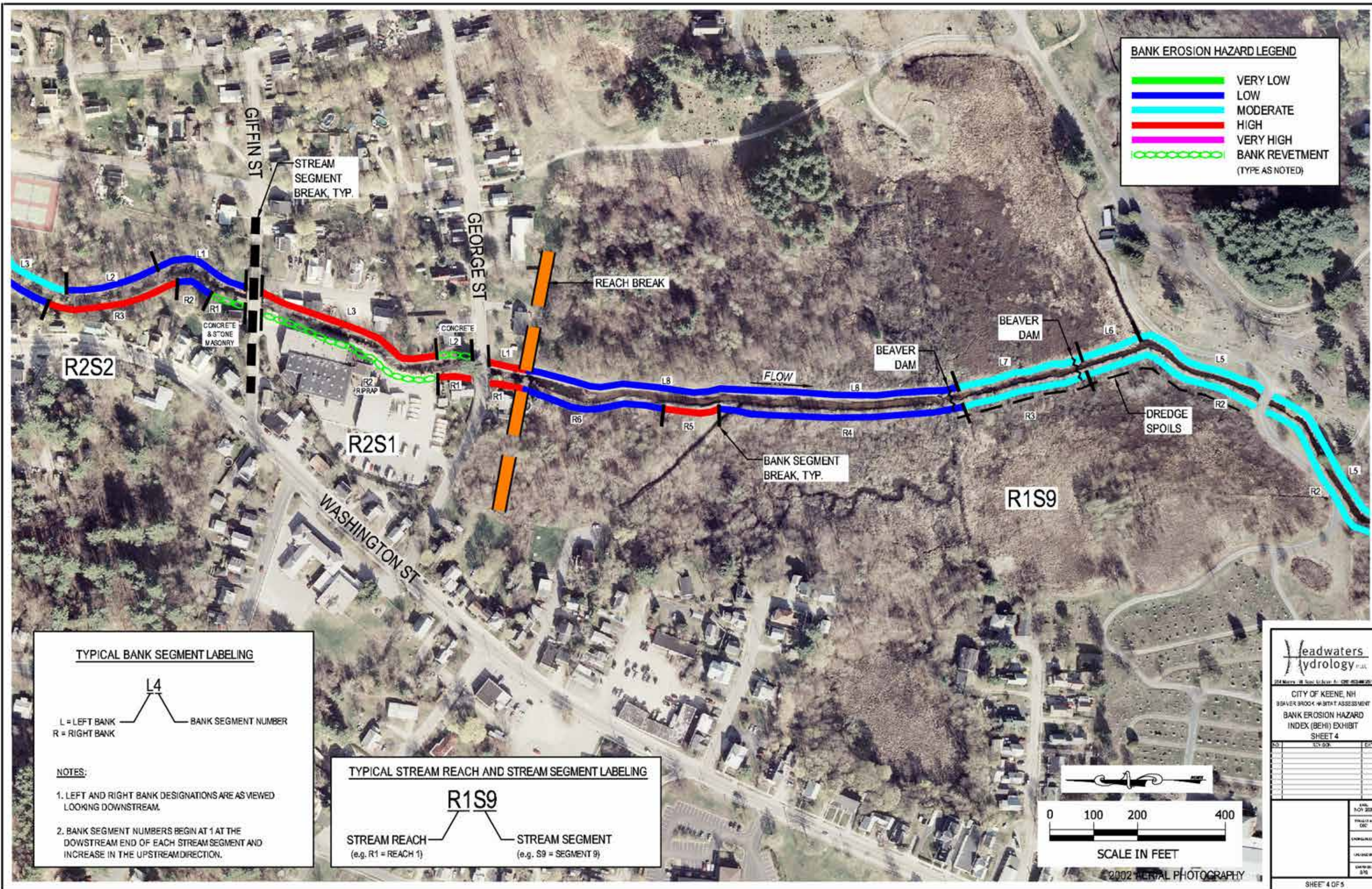
ID	REVISED	DATE

DATE: 8/01/2008  
PROJECT: BEHI  
DRAWN BY: [Name]  
CHECKED BY: [Name]  
SCALE: 1" = 100'

SHEET 3 OF 5



2002 AERIAL PHOTOGRAPHY



**BANK EROSION HAZARD LEGEND**

- █ VERY LOW
- █ LOW
- █ MODERATE
- █ HIGH
- █ VERY HIGH
- ⊖ BANK REVETMENT (TYPE AS NOTED)

**TYPICAL BANK SEGMENT LABELING**

L = LEFT BANK  
R = RIGHT BANK

L4

— BANK SEGMENT NUMBER

**NOTES:**

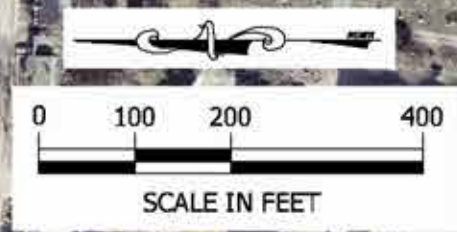
- LEFT AND RIGHT BANK DESIGNATIONS ARE AS VIEWED LOOKING DOWNSTREAM.
- BANK SEGMENT NUMBERS BEGIN AT 1 AT THE DOWNSTREAM END OF EACH STREAM SEGMENT AND INCREASE IN THE UPSTREAM DIRECTION.

**TYPICAL STREAM REACH AND STREAM SEGMENT LABELING**

R1S9

— STREAM REACH (e.g. R1 = REACH 1)

— STREAM SEGMENT (e.g. S9 = SEGMENT 9)



**Headwaters Hydrology, LLC**

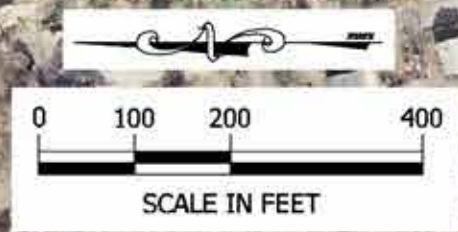
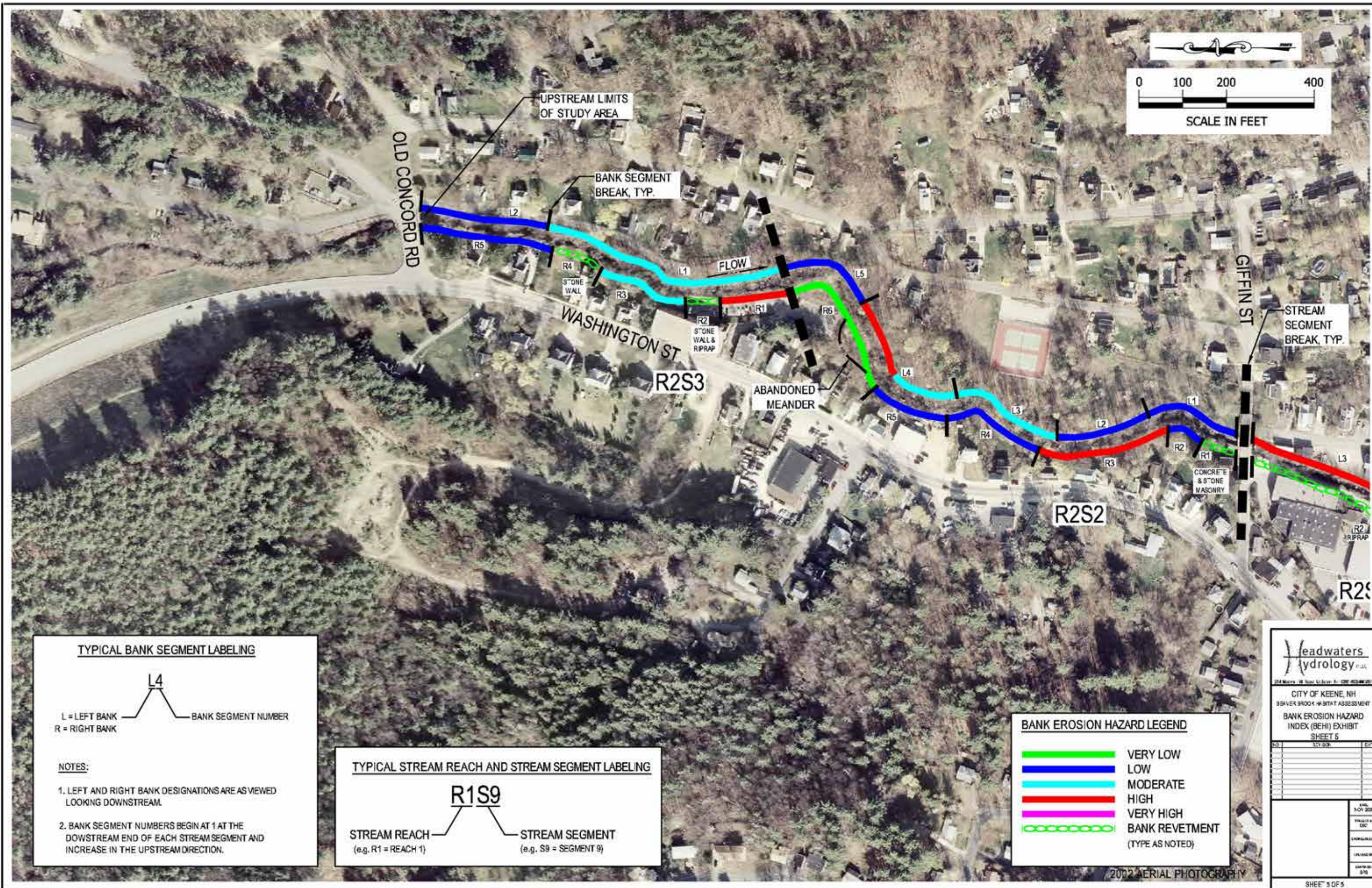
CITY OF KEENE, NH  
BEAVER BROOK HABITAT ASSESSMENT  
BANK EROSION HAZARD INDEX (BEHI) EXHIBIT  
SHEET 4

NO.	REV.	DATE

DATE: 8/10

SHEET 4 OF 5

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**TYPICAL BANK SEGMENT LABELING**

L = LEFT BANK  
R = RIGHT BANK

**NOTES:**

- LEFT AND RIGHT BANK DESIGNATIONS ARE AS VIEWED LOOKING DOWNSTREAM.
- BANK SEGMENT NUMBERS BEGIN AT 1 AT THE DOWNSTREAM END OF EACH STREAM SEGMENT AND INCREASE IN THE UPSTREAM DIRECTION.

**TYPICAL STREAM REACH AND STREAM SEGMENT LABELING**

STREAM REACH (e.g. R1 = REACH 1)

STREAM SEGMENT (e.g. S9 = SEGMENT 9)

**BANK EROSION HAZARD LEGEND**

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH
- BANK REVETMENT (TYPE AS NOTED)

**Headwaters Hydrology**

CITY OF KEENE, NH  
BEAVER BROOK HABITAT ASSESSMENT  
BANK EROSION HAZARD INDEX (BEHI) EXHIBIT  
SHEET 5

NO.	REV.	DATE

DATE: 8/10  
SHEET 5 OF 5

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# **EXHIBIT 11**









Reach	Segment	Bank	BH	BkFH	BHR	BHR Index	RD	RD/BH	RD/BH Index	RD% WRD%	WRD% Index	BA Index	SP Index	Mat	Strat	Total Score	Bank Erosion Potential	
R1	S4	L5	7	2.5	2.8	10.0	6	0.86	2.2	50	42.86	45	40	0	0	25.3	MOD	
										terrace bank along Kingsbury Corp. building, veg is primarily knotweed with some woody shrubs, no active erosion, veg is mowed periodically (photo 93 LUS)								
R1	S4	L6	4	2.5	1.6	6.0	2.5	0.63	3.3	60	37.50	45	70	-15	0	5.5	V LOW	
										gabion baskets with vegetation (lots of knotweed) along Kingsbury Corp. building, floodplain benches have formed along toe of gabion wall in places, vegetation is trimmed frequently, building foundation forms bank at downstream end of bank segment (photo 90 LDS)								
R1	S4	L7	7	2.5	2.8	10.0	3.5	0.50	3.9	60	30.00	90	100	-20	0	8.7	V LOW	
										vegetated, sloping lower bank at toe of concrete wall (photo 89 LDS)								
R1	S4	L8	4	2.5	1.6	6.0	2.5	0.63	3.3	50	31.25	90	100	-15	0	9.0	V LOW	
										gabion baskets with vegetation (photo 84 LDS)								
R1	S4	R1	6.5	2.5	2.6	8.7	5.5	0.85	2.2	60	50.77	60	60	0	0	22.6	MOD	
										high bank with primarily shrubs and saplings and a few large black willows, minor active erosion in a few isolated areas, beaver dam within bank segment (photo 101 LDS)								
R1	S4	R2	8	3	2.7	8.8	7	0.88	2.1	70	61.25	45	30	0	0	23.4	MOD	
										high sloping bank with dense veg, primarily shrubs and saplings, no active erosion (photo 99 LUS)								
R1	S4	R3	2.5	2.5	1.0	1.0	2	0.80	2.5	80	64.00	45	60	0	0	13.3	LOW	
										floodplain bench (~8 ft wide) along toe of upper slope, thick herbaceous and shrubby veg, no active erosion (photo 97 LDS)								
R1	S4	R4	6.5	2.5	2.6	8.7	5.5	0.85	2.2	60	50.77	45	50	0	0	22.7	MOD	
										vegetated terrace bank, mix of herbs and shrubs with red pine at top of bank, no active erosion (photo 94 LDS)								
R1	S4	R5	2.2	2.2	1.0	1.0	1.5	0.68	3.0	70	47.73	60	40	0	0	17.5	LOW	
										narrow bankfull bench along toe of upper bank, primarily herbaceous veg (photo 92 LDS)								
R1	S4	R6	5.2	2	2.6	8.7	4.5	0.87	2.1	60	51.92	45	40	0	0	23.3	MOD	
										terrace bank bordering lawn area, primarily herbaceous veg, no active erosion (photo 91 LDS)								
R1	S4	R7	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW	
										concrete wall, 7 feet high (photo 88 LDS)								
R1	S4	R8	8	2.5	3.2	10.0	6	0.75	2.7	60	45.00	60	70	-15	0	9.0	V LOW	
										gabion baskets with vegetation (photo 85 LDS)								
R1	S5	L1	2.5	2.5	1.0	1.0	1.5	0.60	3.4	60	36.00	90	40	0	0	22.9	MOD	
										primarily herbaceous veg, upper bank is mowed (photo 82 LDS)								

Reach	Segment	Bank	BH	BkFH	BHR	BHR Index	RD	RD/BH	RD/BH Index	RD%	WRD%	WRD% Index	BA Index	SP Index	Mat	Strat	Total Score	Bank Erosion Potential
R1	S5	L2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			stone masonry wall, 5.4 feet high (photo 79 LDS)															
R1	S5	L3	2	2	1.0	1.0	2	1.00	1.0	80	80.00	1.9	3.2	40	0	0	12.2	LOW
			narrow active floodplain bench with thick riparian shrubs (photo 77 LDS)															
R1	S5	R1	2	2	1.0	1.0	2	1.00	1.0	80	80.00	1.9	3.2	50	0	0	11.4	LOW
			narrow floodplain bench with thick riparian shrubs (photo 81 LDS)															
R1	S5	R2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			concrete wall (photo 78 LDS)															
R1	S5	R3	2	2	1.0	1.0	2	1.00	1.0	80	80.00	1.9	3.2	40	0	0	12.2	LOW
			narrow active floodplain bench with thick riparian shrubs (dogwood, willow, alder) overhanging channel (photo 76 LDS)															
R1	S6	L1	6.5	2.5	2.6	8.7	5	0.77	2.6	60	46.15	4.6	3.9	30	0	0	25.7	MOD
			high bank with monocultural stand of knotweed, concrete wall along upper bank beginning about 150 feet downstream from Harrison Street bridge and ending at 90 degree bend (photo 69 LDS, photo 70 LDS, photo 71 LDS, photo 72 LDS, photo 73 LDS)															
R1	S6	L2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			vertical concrete wall, 7.5 feet high (photos 60 and 61 both LDS)															
R1	S6	L3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			stone masonry wall with vegetation (photo 57 LDS)															
R1	S6	R1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			concrete wall/building (photo 75 LDS)															
R1	S6	R2	6.5	2.5	2.6	8.7	5	0.77	2.6	60	46.15	4.6	3.9	30	0	0	25.7	MOD
			high bank with herbaceous and shrubby veg - primarily knotweed (monocultural in some areas), riparian buffer is limited to stream bank (photo 68 LDS, photo 70 LDS, photo 71 LDS, photo 72 LDS, photo 73 LDS)															
R1	S6	R3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			vertical concrete wall, 7.5 feet high (photos 60 and 61 both LDS)															
R1	S6	R4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			stone masonry wall with vegetation (photo 58 LDS)															



Reach	Segment	Bank	BH	BkFH	BHR	BHR Index	RD	RD/BH	RD/BH Index	RD% Index	WRD% Index	WRD% Index	BA Index	SP Index	Mat	Strat	Total Score	Bank Erosion Potential
R1	S9	L5	3.7	2.1	1.8	6.8	2.2	0.59	3.5	70	41.62	5.0	90	50	0	0	27.4	MOD
			narrow riparian buffer along cemetery road, predominantly herbaceous veg (photos 39 and 41 both LDS)															
R1	S9	L6	3.5	2.5	1.4	5.3	3	0.86	2.2	80	68.57	2.8	90	50	0	0	22.5	MOD
			moderate channel incision, channel dredged (photo 37 LDS)															
R1	S9	L7	3	2	1.5	5.9	2.5	0.83	2.3	50	41.67	5.0	75	30	0	0	24.5	MOD
			silt and fine sand bank materials, moderate channel incision, channel dredged, veg: knotweed, dogwood, and elderberry (photo 36 LDS)															
R1	S9	L8	1.9	1.9	1.0	1.0	1.9	1.00	1.0	80	80.00	1.9	45	50	0	0	11.4	LOW
			bank at active floodplain elevation, dense veg including willow, alder, and dogwood (photo 30 LDS)															
R1	S9	R1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
			stone masonry wall, 6 feet high (photo 46 LDS)															
R1	S9	R2	3.5	2.5	1.4	5.3	3	0.86	2.2	80	68.57	2.8	90	50	0	0	22.5	MOD
			moderate channel incision, channel dredged, predominantly knotweed upstream from cemetery bridge (photo 38 LDS)															
R1	S9	R3	3	2	1.5	5.9	2.5	0.83	2.3	50	41.67	5.0	75	30	0	0	24.5	MOD
			silt and fine sand bank materials, monocultural stand of knotweed, moderately incised (photo 35 LDS)															
R1	S9	R4	3.7	3.7	1.0	1.0	3	0.81	2.4	80	64.86	3.1	45	50	0	0	14.0	LOW
			dense woody and herbaceous riparian veg, no active erosion, backwater from beaver dam (photo 33 LDS)															
R1	S9	R5	5	3	1.7	6.3	2	0.40	4.9	30	12.00	8.2	90	20	0	0	34.6	HIGH
			terrace bank dominated by upland herbs and shrubs, silt and fine sand bank materials, active bank erosion (photo 32 LDS)															
R1	S9	R6	1.9	1.9	1.0	1.0	1.9	1.00	1.0	80	80.00	1.9	45	50	0	0	11.4	LOW
			bank at active floodplain elevation, dense riparian veg: willow, alder, dogwood (photo 31 LDS)															

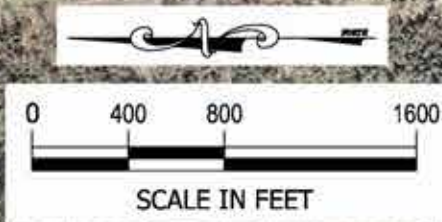
Reach	Segment	Bank	BH	BkFH	BHR	BHR Index	RD	RD/BH	RD/BH Index	RD%	WRD%	WRD% Index	BA	BA Index	SP	SP Index	Mat	Strat	Total Score	Bank Erosion Potential
R2	S1	L1	4	2	2.0	7.9	2.5	0.63	3.3	50	31.25	5.8	75	5.4	30	5.9	0	5	33.3	HIGH
R2	S1	L2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
R2	S1	L3	6	2.5	2.4	8.4	6	1.00	1.0	40	40.00	5.1	90	7.9	30	5.9	0	5	33.3	HIGH
R2	S1	R1	8	2	4.0	10.0	7	0.88	2.1	40	35.00	5.5	75	5.4	10	9.0	5	0	37.0	HIGH
R2	S1	R2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
R2	S2	L1	4.5	2.5	1.8	7.0	4	0.89	2.0	50	44.44	4.8	60	3.9	40	5.1	-5	0	17.7	LOW
R2	S2	L2	2.5	2.5	1.0	1.0	2.5	1.00	1.0	70	70.00	2.7	60	3.9	50	4.3	0	0	12.9	LOW
R2	S2	L3	7	2.5	2.8	10.0	6	0.86	2.2	40	34.29	5.6	60	3.9	25	6.5	0	0	28.2	MOD
R2	S2	L4	3.5	2.3	1.5	6.0	2.5	0.71	2.9	60	42.86	4.9	90	7.9	30	5.9	5	0	32.6	HIGH
R2	S2	L5	13	2	6.5	10.0	12	0.92	1.7	50	46.15	4.6	60	3.9	60	3.5	-5	0	18.7	LOW
R2	S2	R1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	V LOW
R2	S2	R2	3	2.5	1.2	4.0	2	0.67	3.1	60	40.00	5.1	60	3.9	50	4.3	-5	0	15.4	LOW
R2	S2	R3	4	2	2.0	7.9	2	0.50	3.9	50	25.00	6.5	90	7.9	40	5.1	-5	5	31.4	HIGH

knickpoint at upstream end of bank segment (terrace bank below knickpoint), cobble and boulders along toe of bank, abundant knotweed (photo 14 LUS)





# **EXHIBIT 12**



**OLD CONCORD ROAD CROSSING**  
 TYPE: 14'W x 7'H 3-SIDED CONCRETE BRIDGE  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**GEORGE STREET CROSSING**  
 TYPE: 13.5'W x 7.5'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**CEMETERY BRIDGE CROSSING**  
 TYPE: 15.5'W x 5.6'H STEEL AND CONCRETE  
 BRIDGE ON STONE ABUTMENTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**WATER STREET CROSSING**  
 TYPE: 20'W x 8'H CONCRETE ARCH  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**RAIL TRAIL CROSSING**  
 TYPE: 70'W x 11'H SINGLE-SPAN  
 STEEL BRIDGE  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**MARLBORO STREET CROSSING**  
 TYPE: CONCRETE BRIDGE WITH CONCRETE  
 ABUTMENTS AND TWO CONTINUOUS CONCRETE  
 PIERS CREATING 3-7'W x 8.5'H CELLS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**BAKER STREET CROSSING**  
 TYPE: CONCRETE BRIDGE WITH CONCRETE  
 ABUTMENTS AND TWO CONTINUOUS CONCRETE  
 PIERS CREATING 3-8'W x 7.5'H CELLS  
 BOTTOM: CONCRETE WITH ACCUMULATED GRAVEL  
 PERCH OR OTHER BARRIER: NO

**GIFFIN STREET CROSSING**  
 TYPE: 14'W x 6'H 3-SIDED CONCRETE BRIDGE  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: 8" WATER  
 LEVEL DROP OVER CONCRETE SILL ON  
 DOWNSTREAM SIDE OF BRIDGE

**SEWER MAIN CROSSING**  
 PERCH OR OTHER BARRIER: 2.2-FOOT  
 WATER LEVEL DROP OVER EXPOSED  
 CONCRETE-ENCASED SEWER MAIN

**ROXBURY STREET CROSSING**  
 TYPE: 15.5'W x 6.5'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: CONCRETE  
 PERCH OR OTHER BARRIER: -15" DROP  
 ACROSS CONCRETE RAMP BENEATH  
 BRIDGE (POSSIBLE SEWER MAIN)

**HARRISON STREET CROSSING**  
 TYPE: 17.5'W x 6'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: CONCRETE  
 PERCH OR OTHER BARRIER: 8" WATER  
 LEVEL DROP OVER CONCRETE SILL ON  
 DOWNSTREAM SIDE OF BRIDGE

**KINGSBURY CORP DOWNSTREAM  
 BUILDING CROSSING**  
 TYPE: 30'W x 8'H CONCRETE ARCH  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**ROUTE 101 CROSSING**  
 TYPE: 15'W x 8'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: CONCRETE  
 PERCH OR OTHER BARRIER: NO

**BEAVER STREET CROSSING**  
 TYPE: 11'W x 10'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

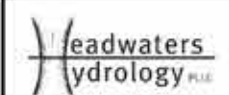
**SPRING STREET CROSSING**  
 TYPE: 18'W x 5.3'H CONCRETE BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**CHURCH STREET CROSSING**  
 TYPE: 13.5'W x 6'H CONCRETE AND  
 STEEL BRIDGE WITH SLOPING  
 CONCRETE ABUTMENTS  
 BOTTOM: CONCRETE  
 PERCH OR OTHER BARRIER: NO

**KINGSBURY CORP UPSTREAM  
 BUILDING CROSSING**  
 TYPE: 3-8'W x 7.5'H CONCRETE BOX CULVERTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**KINGSBURY CORP BRIDGE CROSSING**  
 TYPE: 18'W x 8.3'H CONCRETE AND STEEL BRIDGE  
 WITH CONCRETE ABUTMENTS  
 BOTTOM: NATURAL SUBSTRATE  
 PERCH OR OTHER BARRIER: NO

**ROUTE 12 CROSSING**  
 TYPE: TWIN 10'W x 6.5'H CORRUGATED  
 METAL SQUASH PIPES  
 BOTTOM: CORRUGATED METAL  
 PERCH OR OTHER BARRIER: NO



CITY OF KEENE, NH  
 BEAVER BROOK HABITAT ASSESSMENT  
 BRIDGE AND FISH PASSAGE  
 BARRIER PLAN

NO.	REVISION	DATE

DATE	NOV 2006
PROJECT #	0601
DESIGNED BY	
CHECKED BY	
DRAWN BY	SPS

2002 AERIAL PHOTOGRAPHY

# **EXHIBIT 13**

# Beaver Brook Habitat Assessment Sheet

Ashuelot River tributary, Keene, Cheshire County, New Hampshire

Observers: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Photo ID (if taken): \_\_\_\_\_  
Weather in past 24 hours: \_\_\_\_\_ GPS coordinates (if GPS unit available): \_\_\_\_\_

Location of section (brief, detailed description that will help pinpoint the area):  
\_\_\_\_\_

### Physical properties:

Section type (Circle one): Pool, Riffle, **Glide/Run**, **Cascade** Depth at 1/4 \_\_\_\_\_ 1/2 \_\_\_\_\_ 3/4 \_\_\_\_\_

Definitions on other side of sheet.

Length of section (in ft): \_\_\_\_\_ Average width: \_\_\_\_\_ Maximum depth in section \_\_\_\_\_

Velocity: Time a floating object to travel a known distance. Trial 1 \_\_\_\_\_ feet/sec Trial 2 \_\_\_\_\_ feet/sec  
Avg = \_\_\_\_\_ feet/sec

Stream channel modification (circle one): Natural, Modified

Circle modifications noted: Channelized/straightened, cement embankment, cement bottom, other

Describe briefly:

Estimated % Substrate type (total 100%):		
_____ silt/mud	_____ cobble (3-12")	_____ detritus
_____ sand (<1/4")	_____ boulder (>12")	_____ artificial
_____ gravel (1/4-3")	_____ bedrock	

Fish cover. Circle all that are present and briefly describe:

Large woody **material** on bottom, islands, large boulders, undercut banks, over-hanging vegetation, other

If artificial substrate, indicate type if known (circle): concrete, rip-rap, metal, plastic, other: \_\_\_\_\_

Comments: \_\_\_\_\_

### Riparian zone:

% Land use within 100 feet of both sides (facing upstream):

#### Left Side

\_\_\_\_\_ mature forest \_\_\_\_\_ industrial urban  
\_\_\_\_\_ immature forest \_\_\_\_\_ suburban/residential/park  
\_\_\_\_\_ shrub/thicket \_\_\_\_\_ construction  
\_\_\_\_\_ marsh/wetland \_\_\_\_\_ road  
\_\_\_\_\_ field/agricultural \_\_\_\_\_ other (describe): \_\_\_\_\_

#### Right side

\_\_\_\_\_ mature forest \_\_\_\_\_ industrial urban  
\_\_\_\_\_ immature forest \_\_\_\_\_ suburban/residential/park  
\_\_\_\_\_ shrub/thicket \_\_\_\_\_ construction  
\_\_\_\_\_ marsh/wetland \_\_\_\_\_ road  
\_\_\_\_\_ field/agricultural \_\_\_\_\_ other: \_\_\_\_\_

Comments:

Estimated width of vegetative buffer on both sides: (See \* on other side of sheet)

Left	Right
_____	_____ >100'
_____	_____ 50-100'
_____	_____ 10-50'
_____	_____ 1-10'
_____	_____ None

Vegetation dominant species, if known:

Invasive species present, if known:

### Outfalls:

Describe location of each outfall in the section. Include pipes, ditches, and any other drainage or discharge features:  
Landmarks or other description that will help to pinpoint location?

Any flow from outfall? Describe:

Circle all that apply: Turbid, clear, color, floatables (e.g., suds, etc.), oily sheen (if so, does it fragment when touched?), evidence of other pollutants \_\_\_\_\_

Dams or other obstruction to fish passage? Yes, No

Comments (continue on back if necessary):

**Definitions:**

**POOL (P):** Aquatic habitat in a stream with a gradient less than 1% that is normally deeper and wider than aquatic habitats immediately above and below it. Depth is usually, but not always, greater than about 2 feet for first order (small) streams and greater than 3.0 feet for second order (or above) streams.

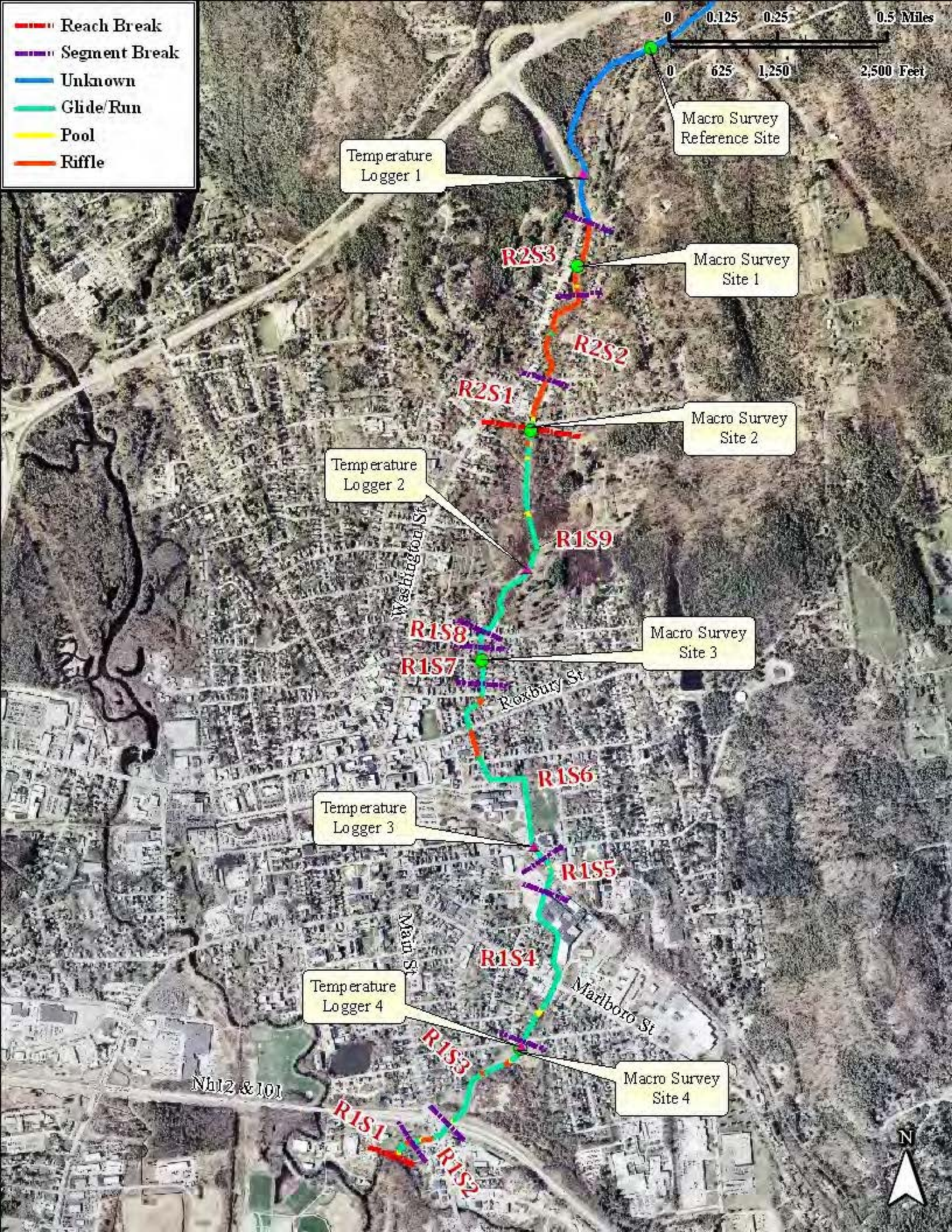
**RIFFLE (R):** Shallow reaches of a stream (1-4% gradient) characterized by small hydraulic jumps over rough bed material, causing small ripples, waves, and eddies. Generally, the water surface is broken up by turbulence.

**GLIDE (G):** A transitional zone between pools and riffles, a run/glide has swift uniform (laminar) flow **without** surface agitation or waves. Maximum depth is about 5% or less of the average stream width. Do not confuse glides with the downstream ends of pools.

**CASCADE (C):** An area of high turbulence and coarse substrate with a gradient > 4%. These appears as small waterfalls or a series of small waterfalls cascading over coarse substrate, typically small boulders or bigger.

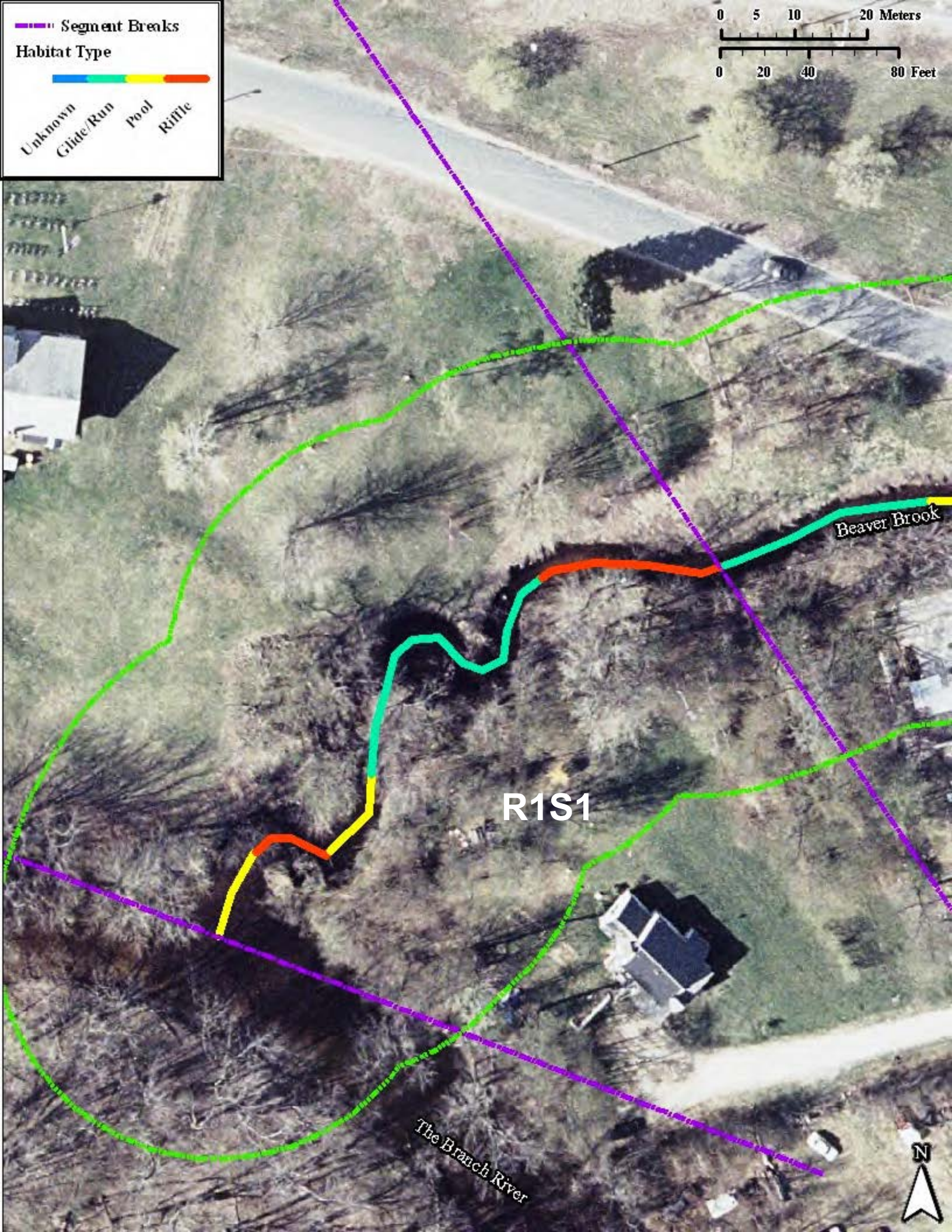
\*Note that lawns, mowed grass and agricultural crops can be part of the "riparian zone", but are not considered part of the "vegetated buffer".

# **EXHIBIT 14**



Segment Breaks  
 Habitat Type

Unknown  
 Glide/Run  
 Pool  
 Riffle

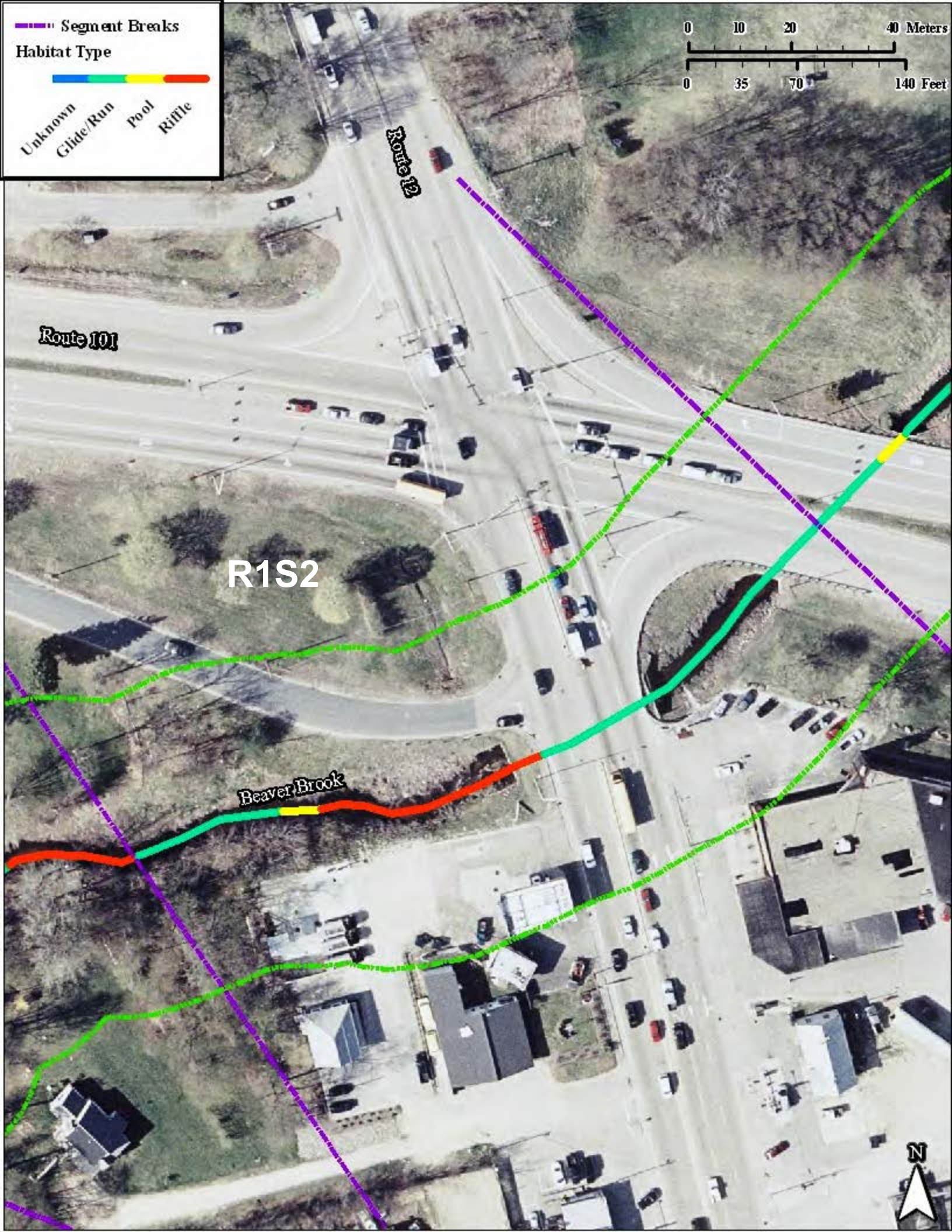




Segment Breaks  
Habitat Type



Unknown  
Glide/Run  
Pool  
Riffle



Route 101

Route 212

R1S2

Beaver Brook





Segment Breaks

Habitat Type

Unknown  
Glide/Run  
Pool  
Riffle

Temperature  
Logger 4

Macro Survey  
Site 4

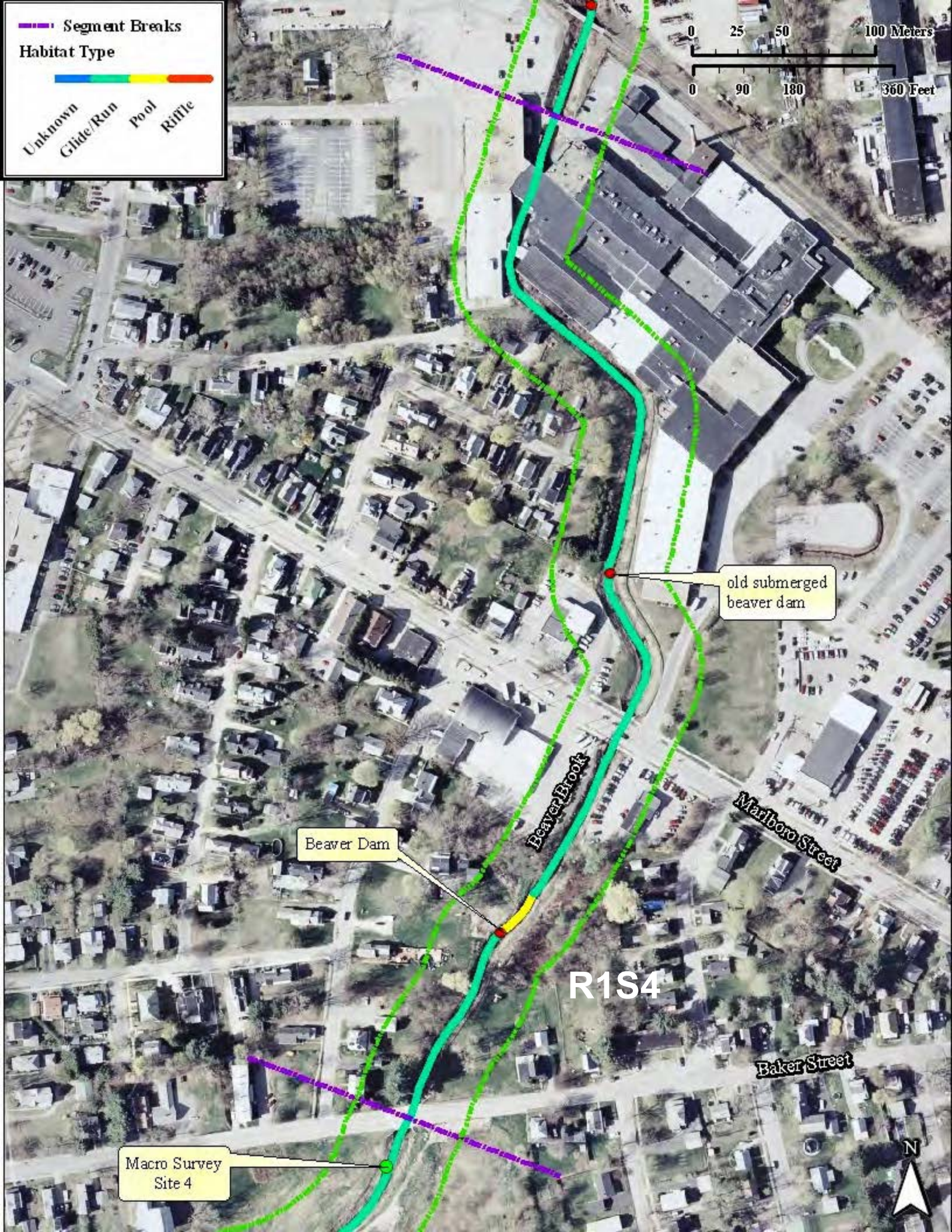
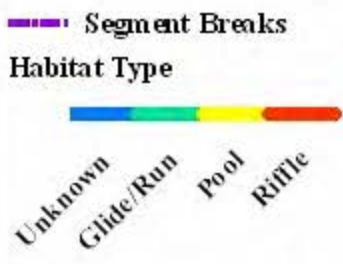
Baker Street

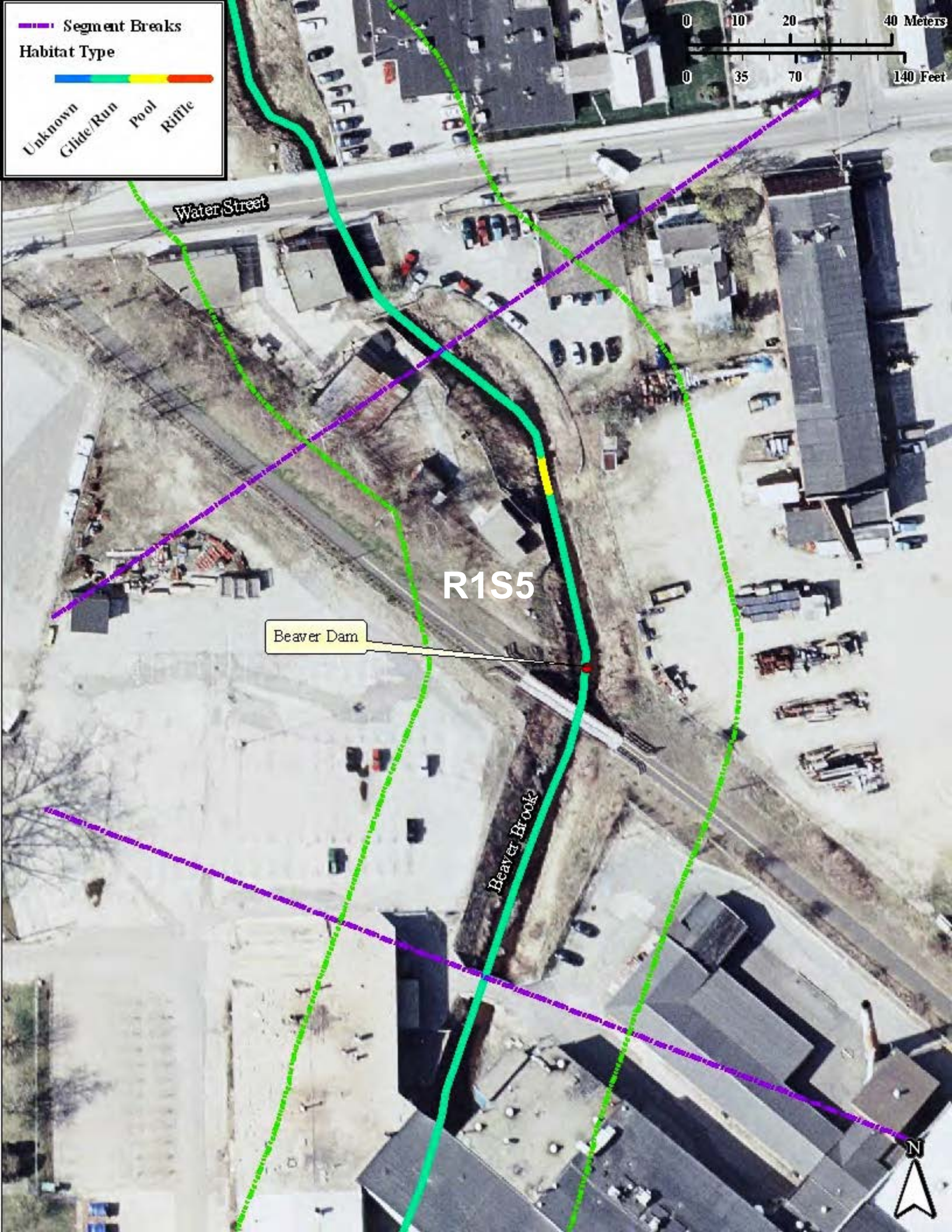
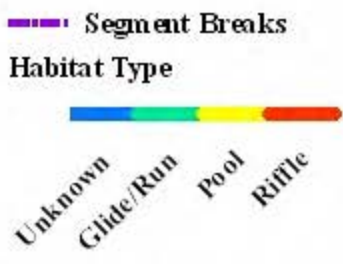
Beaver Brook

R1S3

Route 101







— · — · Segment Breaks  
**Habitat Type**  
— — — — —  
 Unknown  
 Glide/Run  
 Pool  
 Riffle



concrete step in channel

Roxbury Street

Church Street

concrete step in channel

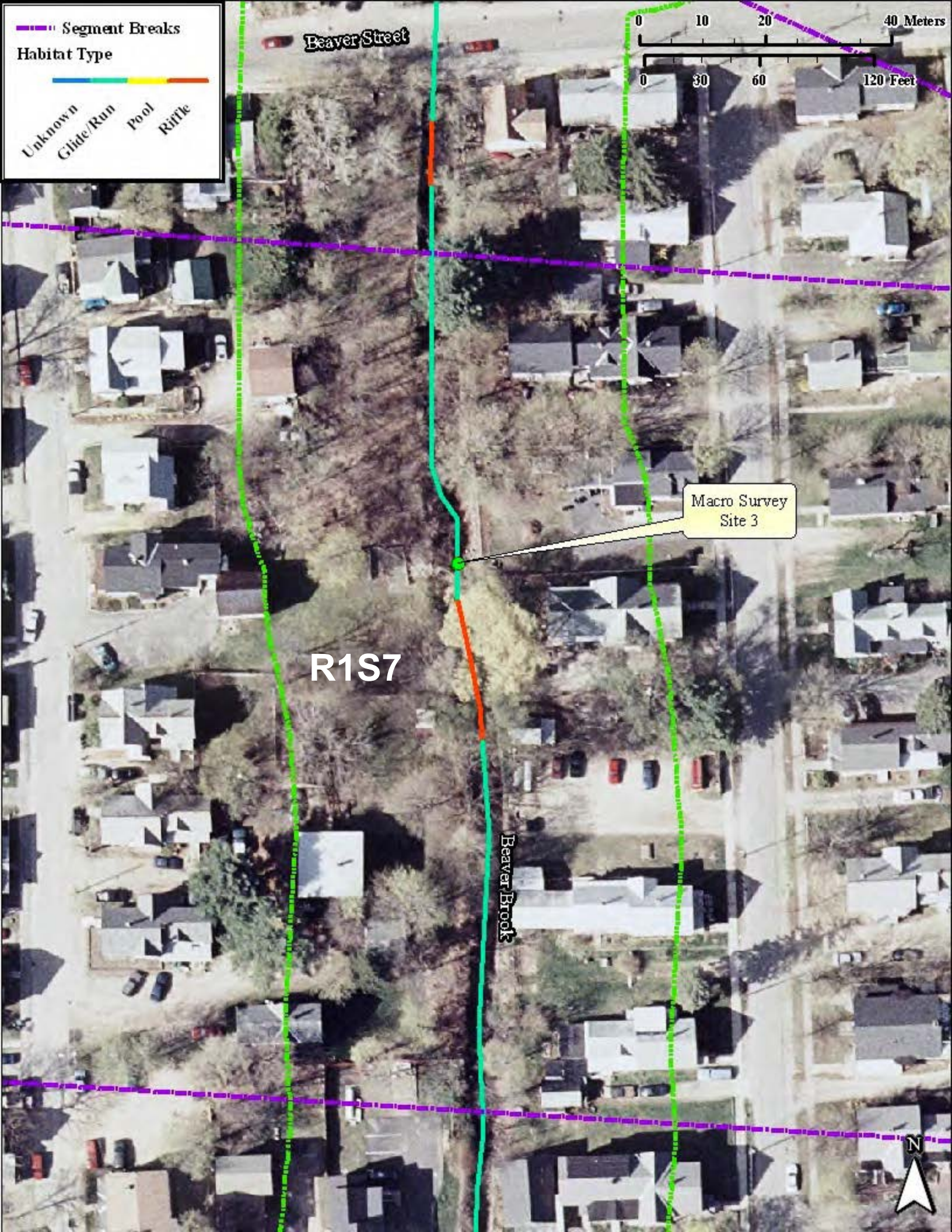
Beaver Brook

R1S6

Temperature Logger 3

Water Street



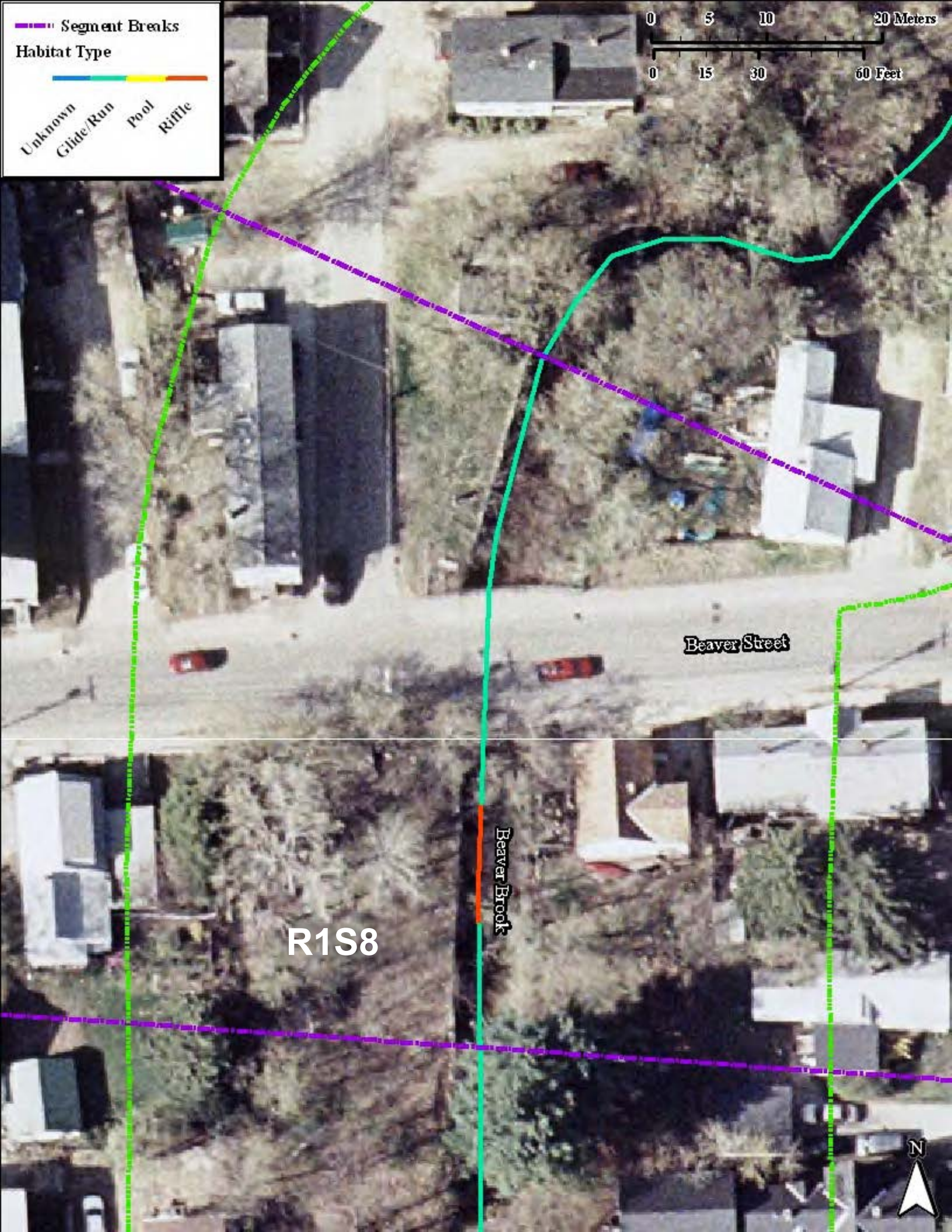


Segment Breaks

Habitat Type



Unknown  
Glide/Run  
Pool  
Riffle

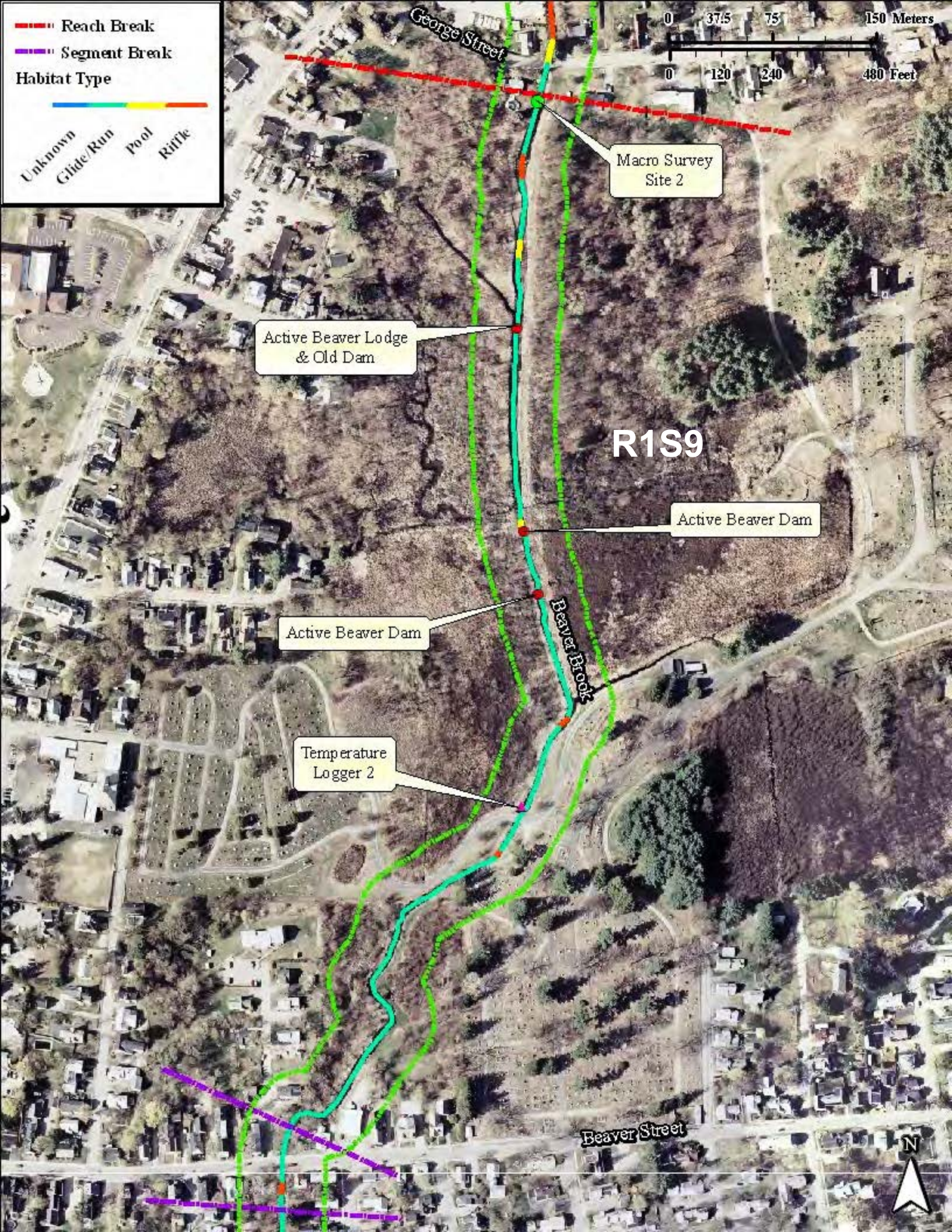


Beaver Street

Beaver Brook

R1S8





--- Reach Break

--- Segment Break

Habitat Type



Macro Survey Site 2

Active Beaver Lodge & Old Dam

R1S9

Active Beaver Dam

Active Beaver Dam

Temperature Logger 2

Beaver Brook

Beaver Street



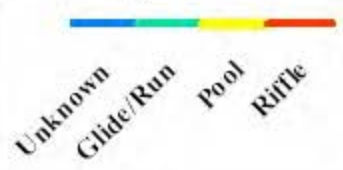




--- Reach Break

--- Segment Break

Habitat Type



Concrete Step in Channel

Giffin Street

Beaver Brook

R2S1

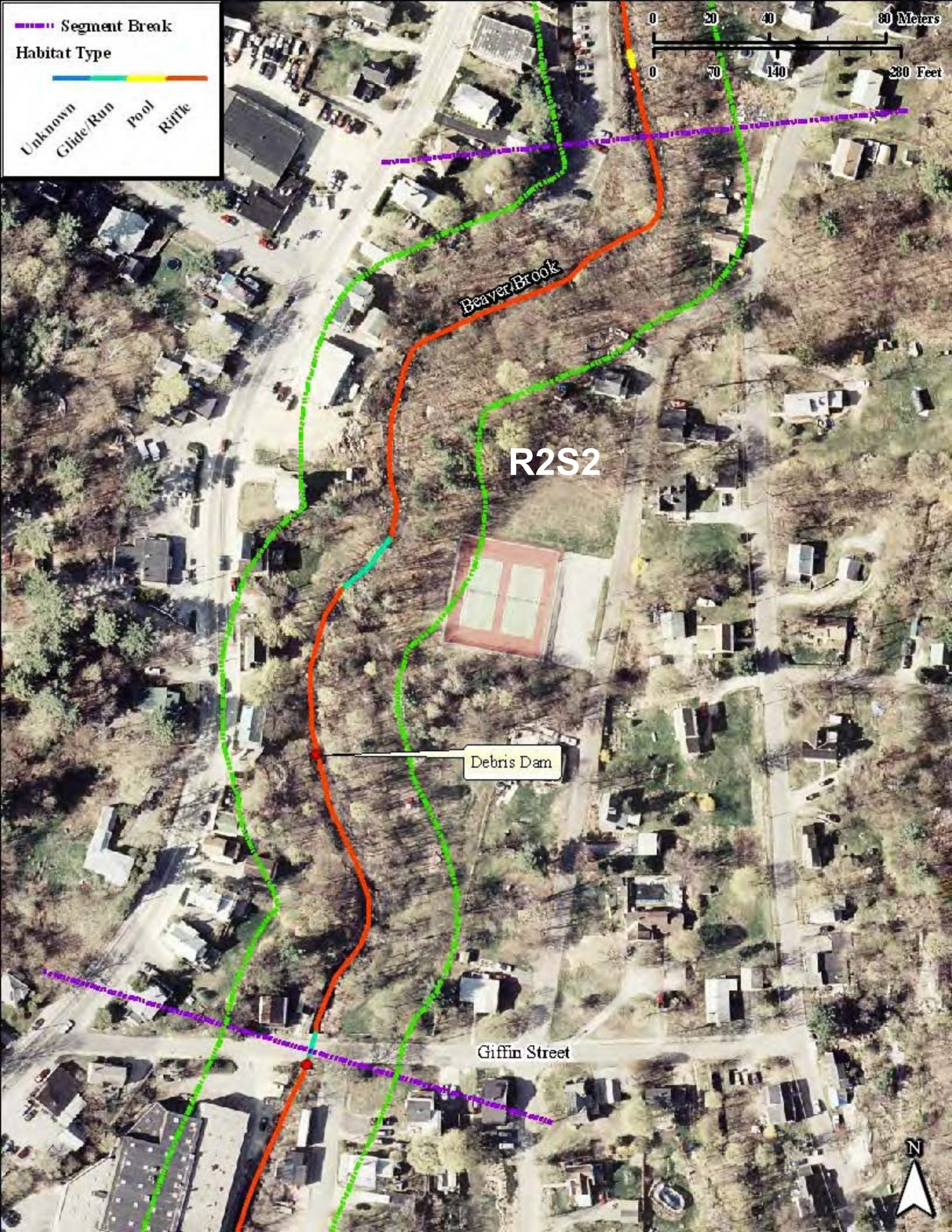
Concrete Structure in Channel

George Street

Macro Survey Site 2



- - - - Segment Break  
 Habitat Type  
— — — — —  
 Unknown    Glide/Run    Pool    Riffle



Beaver Brook

R2S2

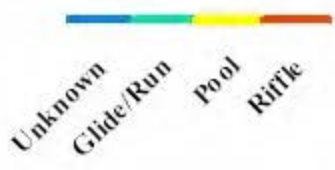
Debris Dam

Giffin Street



Segment Break

Habitat Type



Old Concord Road

Beaver Brook

R2S3

Macro Survey Site 1



- - - Segment Break  
 Habitat Type  
— — — —  
 Unknown  
 Glide/Run  
 Pool  
 Riffle



Reference Reach

Beaver Brook

Macro Survey Reference Site

Old Concord Road



# **EXHIBIT 15**

**Reach 1, Segment 1**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Pool	42	12%	15	26	sand	none
Riffle	39	11%	15	5	sand	none
Pool	42	12%	12	29	sand	none
Glide/Run	155	43%	7	9	sand	none
Riffle	85	23%	10	7	sand/gravel	none

**Reach 1, Segment 2**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	98	17%	14	22	gravel	none
Pool	25	4%	14	43	gravel	none
Riffle	152	27%	14	9	sand/gravel	steel culverts under Rte 12
Glide/Run	291	51%	16	17	sand	Rte 101 concrete culverts/bridge

**Reach 1, Segment 3**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Pool	23	2%	20	33	sand	none
Glide/Run	681	49%	15	23	sand	none
Riffle	59	4%	15	12	silt/mud	none
Glide/Run	258	19%	13	14	sand	none
Riffle	72	5%	10	10	sand/silt	none
Pool	21	2%	10	25	sand	none
Glide/Run	276	20%	13	22	sand	none

**Reach 1, Segment 4**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	375	17%	12	22	silt/mud	some concrete
Pool	94	4%	18	32	silt/mud	none
Glide/Run	1715	79%	15	28	sand	some concrete & rip-rap

**Reach 1, Segment 5**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	200	44%	10	25	sand	some concrete & rip-rap
Pool	25	6%	12	28	sand	some concrete & rip-rap
Glide/Run	225	50%	10	32	sand	some concrete & rip-rap

**Reach 1, Segment 6**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	0	0%	15	32	sand	straightened; some cement embankments
Glide/Run	350	13%	16	15	concrete	concrete walls & bottom
Riffle	136	5%	16	12	sand	concrete walls & bottom
Glide/Run	374	14%	16	15	concrete	concrete walls & bottom
Riffle	339	12%	15	32	boulder/cobble	concrete walls & bottom
Glide/Run	134	5%	15	31	silt/sand	concrete walls & bottom

**Reach 1, Segment 7**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	187	41%	15	16	unknown	concrete on one side
Riffle	74	16%	15	7	cobble	none
Glide/Run	200	43%	15	15	unknown	none

**Reach 1, Segment 8**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Riffle	35	18%	16		boulder	
Glide/Run	162	82%	16	37	unknown	

**Reach 1, Segment 9**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Glide/Run	299	11%	16	14	boulder	
Pool	41	1%	15	33	boulder	
Glide/Run	1082	39%	15	42	sand/gravel	
Riffle	54	2%	15	5	cobble	
Pool	27	1%	15	53	sand/gravel	beaver dam backs up water into deep pool; straightened
Riffle	27	1%	15	5	gravel	straightened
Glide/Run	225	8%	15	26	sand/gravel	straightened
Riffle	24	1%	15	4	cobble	straightened
Glide/Run	1018	36%	16	15	sand/gravel	straightened

**Reach 2, Segment 1**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Riffle	495	80%	13	17	cobble/boulder	cement step at edge of bridge; large concrete structure across stream
Pool	44	7%	20	37	cobble	
Glide/Run	76	12%	16	37	cobble	

**Reach 2, Segment 2**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Riffle	461	37%	16	16	cobble/boulder	
Glide/Run	82	7%	16	18	cobble	
Riffle	687	56%	16	16	cobble/boulder	concrete embankment

**Reach 2, Segment 3**

Habitat Type	Linear Distance (ft)	% of Segment	Average Width (ft)	Maximum Depth (in)	Dominant Substrate	Stream Modifications
Riffle	796	89%	18	18	boulder	
Pool	16	2%	12	23	boulder	
Riffle	82	9%	16	15	boulder	

# **EXHIBIT 16**



Beaver Brook Known Fish Species

**Coldwater Fish**

Common Name	Scientific Name	Family	Temp Range	Location(s)	Date(s)	Notes
Atlantic Salmon	<i>Salmo salar</i>	Salmonidae	Optimal: 4-19°C (39.2-66.2°F) w/ absolute lethal limit of 25-28°C (77-82.4°F)	Washington St Extension	9/10/2008	
Eastern Brook Trout	<i>Salvelinus fontinalis</i>	Salmonidae	Optimum: 11-16°C (51.8°-60.8°F) w/ absolute lethal limit of 25.3°C (77.5°F)	RR St/Water St,	10/18/2003	
				Woodlawn Cemetery,	10/17/2006	several found during demo for World Monitoring Day
				Washington St Extension	10/9/2003	Several were fat with milt or eggs. Splashing in the shallows from spawning.
Longnose Dace	<i>Rhinichthys cataractae</i>	Cyprinidae	4 – 16°C (39.2-60.8°F)	Woodlawn Cemetery,	9/10/2008	
				Washington St Extension	10/9/2003, 9/10/2008	
Yellow Bullhead	<i>Ameiurus natalis</i>	Ictaluridae	5 – 15°C (41-59°F)	RR St/Water St	6/2/2004	

**Cool - Warmwater Fish**

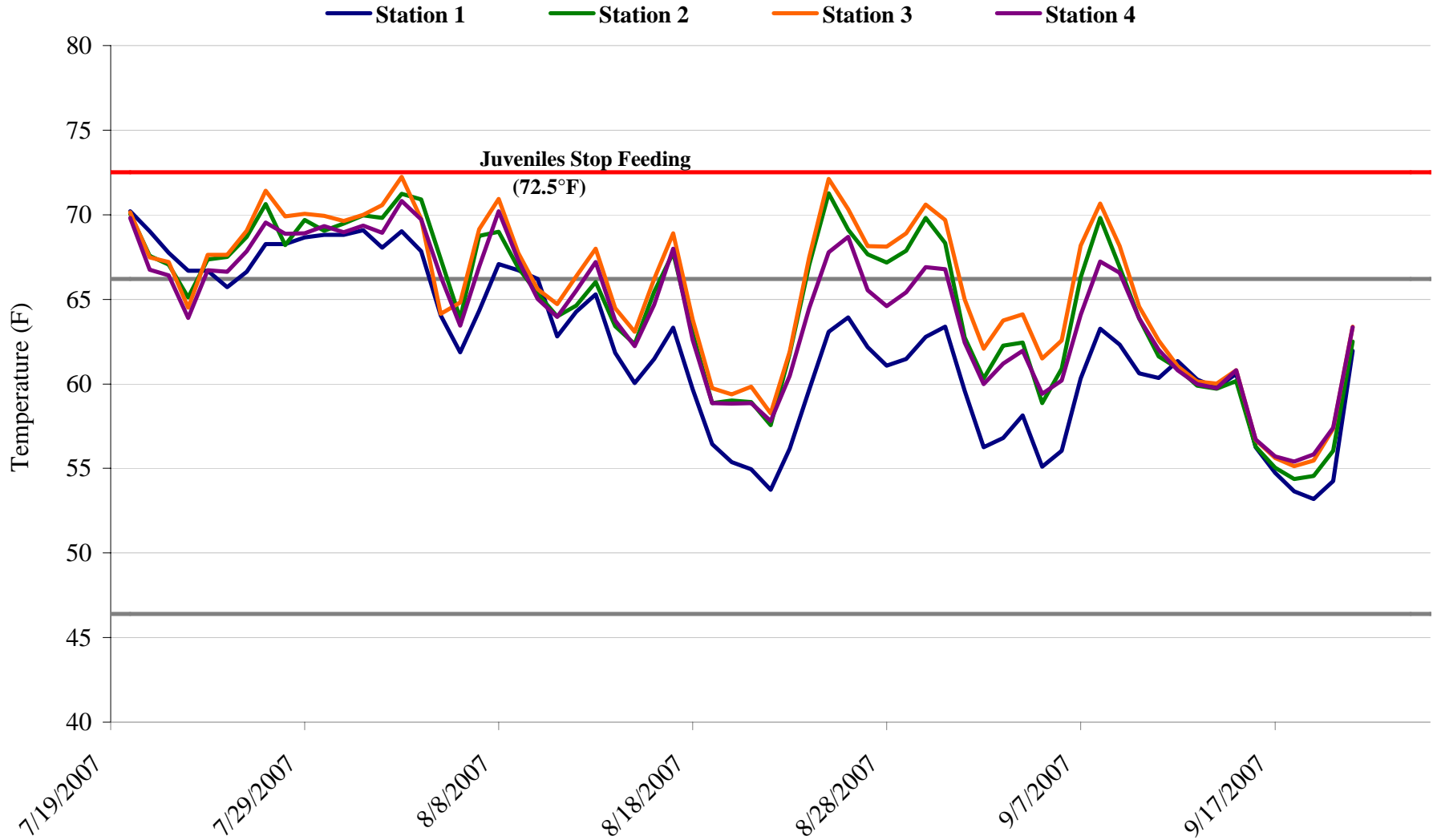
Common Name	Scientific Name	Family	Temp Range	Location(s)	Date(s)	Notes
Blacknose Dace	<i>Rhinichthys atratulus</i>	Cyprinidae	5-25°C (41-77°F)	RR St/Water St,	10/9/2003, 6/2/2004, 9/10/2008	
				Woodlawn Cemetery,	9/10/2008	
				Washington St Extension	10/9/2003, 9/10/2008	
Brown Bullhead	<i>Ameiurus nebulosus</i>	Ictaluridae	survive temps up to 36°C (96.8°F)	RR St/Water St	6/2/2004	
Common Shiner	<i>Luxilus cornutus</i>	Cypriniformes	3-33°C (37.4-91.4°F)	RR St/Water St,	10/9/2003, 6/2/2004, 9/10/2008	abundant
				Woodlawn Cemetery	9/10/2008	
				Washington St Extension	10/9/2003, 9/10/2008	

Beaver Brook Known Fish Species

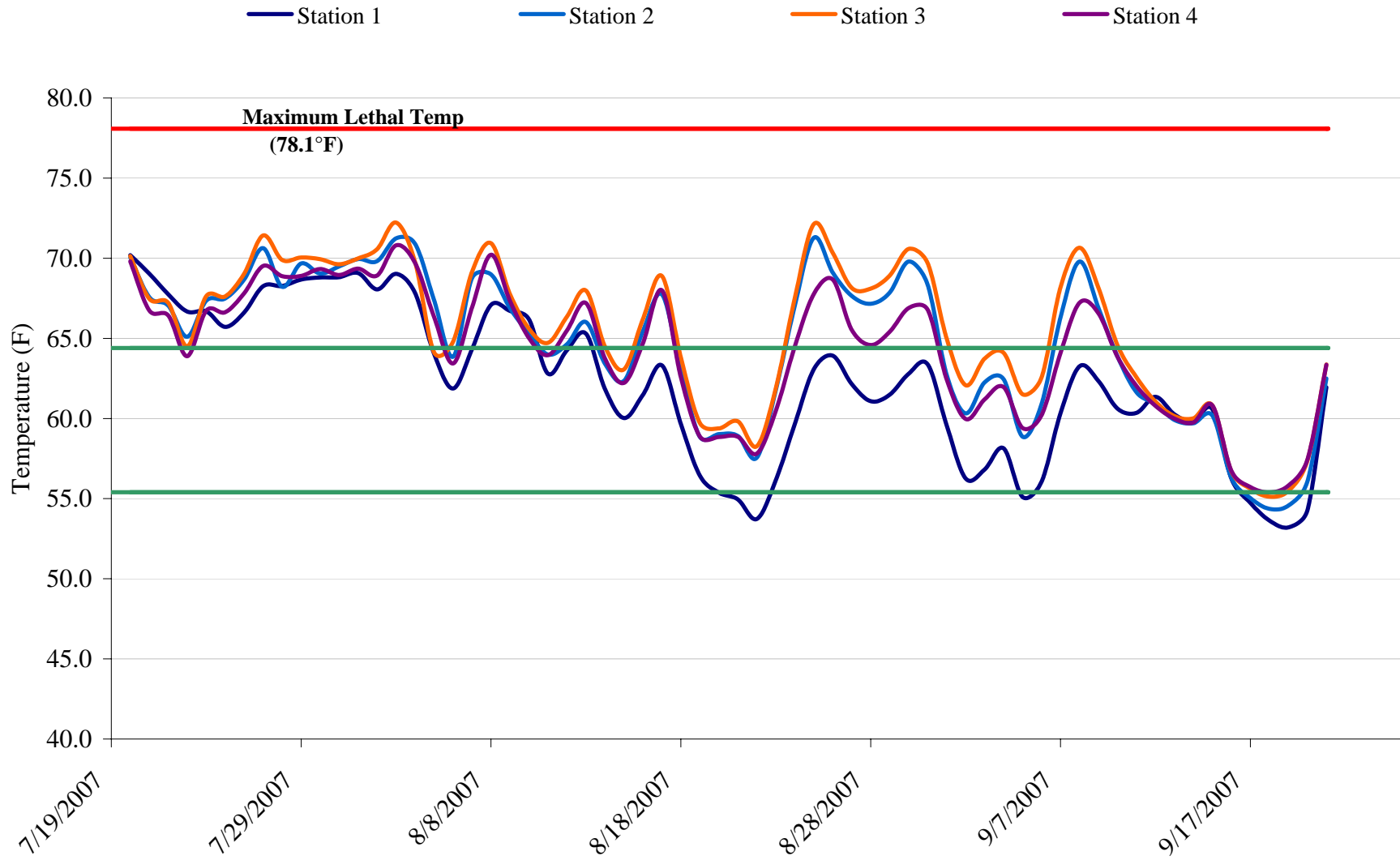
Common Name	Scientific Name	Family	Temp Range	Location(s)	Date(s)	Notes
Common Sunfish/ Pumpkinseed	<i>Lepomis gibbosus</i>	Centrarchidae	8-37.8°C (46.4-100°F)	RR St/Water St,	10/9/2003, 6/2/2004 9/10/2008	Young-of-year
				Washington St Extension	10/9/2003	
Common White Sucker	<i>Catostomus commersonii</i>	Catostomidae	0 – 29°C (32-84.2°F)	RR St/Water St,	10/9/2003, 6/2/2004, 9/10/2008	Abundant, Most less than 6"
				Woodlawn Cemetery	9/10/2008	
				Washington St Extension	10/9/2003, 9/10/2008	
Creek Chub	<i>Semotilus atromaculatus</i>	Cyprinidae	0 – 30°C (32-86°F)	RR St/Water St, Washington St Extension	10/9/2003, 9/10/2008	
Fallfish	<i>Semotilus corporalis</i>	Cyprinidae		RR St/Water St, Woodlawn Cemetery	9/10/2008	
Golden Shiner	<i>Notemigonus crysoleucas</i>	Cyprinidae	0 – 35°C (32-95°F)	RR St/Water St	6/2/2004	1 golden shiner
Largemouth Bass	<i>Micropterus salmoides</i>	Centrarchidae	10 – 32°C (50-89.6°F)	RR St/Water St	10/9/2003, 9/10/2008	Young-of-year
Tessellated Darter	<i>Etheostoma olmstedi</i>	Percidae	10 – 24°C (50-75.2°F)	RR St/Water St,	10/9/2003, 6/2/2004, 9/10/2008	
				Woodlawn Cemetery	9/10/2008	
Yellow Perch	<i>Perca flavescens</i>	Percidae	0 – 30°C (32-86°F)	RR St/Water St	10/9/2003, 9/10/2008	Young-of-year

# **EXHIBIT 17**

# Beaver Brook Daily Average Temperatures plotted against Juvenile Atlantic Salmon Temperature Requirements



# Beaver Brook Daily Average Temperatures plotted against Brook Trout Temperature Tolerances



# **EXHIBIT 18**

2008 Beaver Brook MacroInvertebrate Study

Organism			Feeding Group	Tolerance Value	Tolerance Value Source	Region	Reference Site		Site 1		Site 2		Site 3		Site 4	
Order	Family	Common Name					Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Coleoptera	Elmidae (larvae)	Riffle Beetle Larvae	Collector/Gatherers	4	US EPA	Northwest	1		1	1	1	1	1	1		
Coleoptera	Elmidae (adult)	Adult Riffle Beetle	Collector/Gatherers	4	US EPA	Northwest	1					1		1		
Diptera	Athericidae	Aquatic Snipe Flies	Predators	2	US EPA	Mid-Atlantic	2	2			2	1	1			
Diptera	Ceratopogonidae	Biting Midges, No-See-Ums	Predators	6	US EPA	Northwest	3	3			1	2				
Diptera	Chironomidae	Non-Biting Midges	Collector/Gatherers	7	CT DEP	Connecticut		2		2	3	1				
Diptera	Simuliidae	Black Fly Larvae	Collector/Filterer	6	US EPA & CT DEP	Mid-Atlantic/Connecticut			1	2			1	1		
Diptera	Tipulidae	Crane Fly Larvae	Shredders	3	US EPA	Northwest	2	5	1	1	1	1	1		1	
Ephemeroptera	Baetidae	Small Minnow Mayflies	Collector/Gatherers	4	US EPA	Mid-Atlantic					1					
Ephemeroptera	Ephemerellidae	Body-builder Mayfly	Scrapers	0	CT DEP	Connecticut	2	4								
Ephemeroptera	Heptageniidae	Flathead Mayflies	Scrapers	4	CT DEP	Connecticut	4	16	3	5		3		2		
Ephemeroptera	Leptophlebiidae	Prong-Gilled Mayflies	Collector/Gatherers	2	US EPA	Northwest	38	17	1	6						
Ephemeroptera	Tricorythidae	Little Stout Crawler Mayflies	Collector/Gatherers	4	US EPA	Northwest			1							
Gastropoda	Pulmonata	Snails	Scrapers	7	US EPA & CT DEP	Mid-Atlantic/Connecticut									1	
Megaloptera	Corydalidae	Dobsonflies, Fishflies, Hellgramites	Predators	5	CT DEP	Connecticut	1	6	3	1		1	3	2		
Odonata	Anisoptera (Suborder)	Dragon Fly Nymph	Predators	5	CT DEP	Connecticut					3				1	
Oligochaeta (Class)		Aquatic Earthworm	Collector/Gatherers	9	CT DEP	Connecticut		2	1		7	3			7	1
Pecopectera	Capniidae	Small Winter Stoneflies	Shredders	1	US EPA	Mid-Atlantic		1								
Plecoptera	Chloroperlidae	Green Stoneflies	Predators	1	US EPA	Northwest	2		2	1						
Plecoptera	Leuctridae	Rolled-winged Stoneflies	Shredders	0	US EPA	Northwest		1								
Plecoptera	Perlidae	Common Stoneflies	Predators	1	US EPA & CT DEP	Mid-Atlantic/Connecticut	9	14	1	4						
Plecoptera	Pteronarcyidae	Giant Stoneflies	Shredders	0	CT DEP	Connecticut							1			
Trichoptera	Hydropsychidae	Common Net-Spinner Caddisflies	Collector/Filterer	4	US EPA & CT DEP	Mid-Atlantic/Connecticut	16	13	2	7	1	6	26	17		
Trichoptera	Philopotamidae	Fingernet Caddisfly	Collector/Filterer	3	US EPA & CT DEP	Mid-Atlantic/Connecticut	1	1								
Trichoptera	Polycentropodidae	Tube-Making and Trumpet-Net Caddisflies	Collector/Filterers	no tolerance value listed on either EPA or CT DEP			5	2		2						
<b>Total Organisms</b>							<b>87</b>	<b>89</b>	<b>16</b>	<b>32</b>	<b>13</b>	<b>24</b>	<b>34</b>	<b>24</b>	<b>10</b>	<b>4</b>

## 2008 Beaver Brook MacroInvertebrate Study

Tolerance Values were taken from the following 2 sources:

- 1) Connecticut Department of Environmental Protection (CT DEP), Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors, Macroinvertebrate Field Identification Cards
- 2) US Environmental Protection Agency, Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Appendix B: Regional Tolerance Values, Functional Feeding Groups and Habit/Behavior Assignments for Benthic Macroinvertebrates.

Feeding Groups were taken from the US EPA, Rapid Bioassessment Protocols, Appendix B.

**Tolerance Values are on a scale of 0 to 10 with 0 being an extremely sensitive organism and 10 being tolerant.**

Macroinvertebrates with high tolerance values may be found in all types of water quality while those with lower values are usually only found in streams characterized by higher water quality.

### Reference Site:

Location: North of study area, off of Washington Street Extension

Lat: 42.9545      Long: -72.2697

Date Sampled: 10/15/08   Time: 10:20 am

Crew: Jeff Littleton & Jen Holton

Weather: Clear & Calm   Flow: Moderate

Site Description: Riffles with predominately boulder & cobble substrate.

No obvious trash or pollution present. Intact Floodplain.

### Site 1:

Location: Off of Upper Knight Street

Lat: 42.949774      Long: -72.269501

Date Sampled: 9/2908   Time: 9:30 am

Crew: Jeff Littleton & Jen Holton

Weather: Warm & Partly Cloudy   Flow: Moderate

Site Description: Riffles with steps. Primarily boulder & cobble substrate.

Some trash present. No floodplain.

### Site 2:

Location: South of George Street Bridge

Lat: 42.944364      Long: -72.271589

Date Sampled: 9/2908   Time: 11 am

Crew: Jeff Littleton & Jen Holton

Weather: Warm & Mostly Cloudy   Flow: Moderate

Site Description: Shallow riffles with primarily gravel & sand substrate

Some trash present. Stone masonry walls.

3 spring salamanders found & released.

### Site 3:

Location: South of Beaver Street

Lat: 42.936737      Long: -72.273747

Date Sampled: 9/2908   Time: 2:30 pm

Crew: Jeff Littleton & Jen Holton

Weather: Warm & Partly Cloudy   Flow: Moderate

Site Description: Riffles with primarily cobble substrate.

Some trash present. Next to cleared lot.

Kids built a rock dam across top of lower riffle.

Stone masonry walls. Lots of brick in channel.

### Site 4:

Location: Just south of Baker Street Bridge

Lat: 42.923913      Long: -72.271904

Date Sampled: 9/2908   Time: 1 pm

Crew: Jeff Littleton & Jen Holton

Weather: Warm & Partly Cloudy   Flow: Moderate

Site Description: Riffles with primarily sand & gravel substrate.

Some trash present. Cement bottom under Baker Street bridge.

Instream veg & islands.