Fish Attraction Structure Habitat Improvement Project: 2009 Monitoring Report

Niagara Power Project (FERC No. 2216)

PREPARED BY:

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PREPARED FOR:

NEW YORK POWER AUTHORITY

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1.0 INTRODUCTION

The New York Power Authority's (NYPA) Niagara Power Project (Project) is licensed by the Federal Energy Regulatory Commission (FERC). As part of the relicensing process, NYPA, state and federal resource agencies, local governments, nongovernmental organizations, and other stakeholders signed a Comprehensive Relicensing Settlement Agreement that requires NYPA to develop several Habitat Improvement Projects (HIPs) in the vicinity of Project lands and waters.

One of these HIPs involves the construction and monitoring of fish attraction structures in the Upper Niagara River to provide large-object cover in new areas where fish of various sizes can feed, rest, and seek shelter. In October 2008, NYPA constructed four fish attraction structures in the upper river using a barge at four locations. Each consisted of a different design. One shallow-water structure used a stone-and-log groin design while three deep-water structures used a boulder field, rock-wing saddleback, or rock slope design.

The following sections of this report provide the September 2009 monitoring results of the structures, which was conducted one year after their installation.

2.0 OBJECTIVE

Monitoring requirements for this HIP were outlined in the HIPs Report (Kleinschmidt Associates and Riveredge Associates, 2005). Specifically, the monitoring objective is to gather and provide data to determine if the fish attraction structures are maintaining their structural integrity. An ancillary objective for NYPA is to qualitatively evaluate structure use by fish. Monitoring is scheduled to be conducted once per year in years 1, 4, 7, and 10, following construction; 2009 represents the first post-construction monitoring event.

3.0 METHODS

Monitoring was conducted according to the *Fish Attraction Structure Monitoring Plan* (Kleinschmidt Associates, 2009). As such, monitoring was performed on September 23-24, 2009 by SCUBA divers who visually inspected the structures and conducted qualitative surveys at

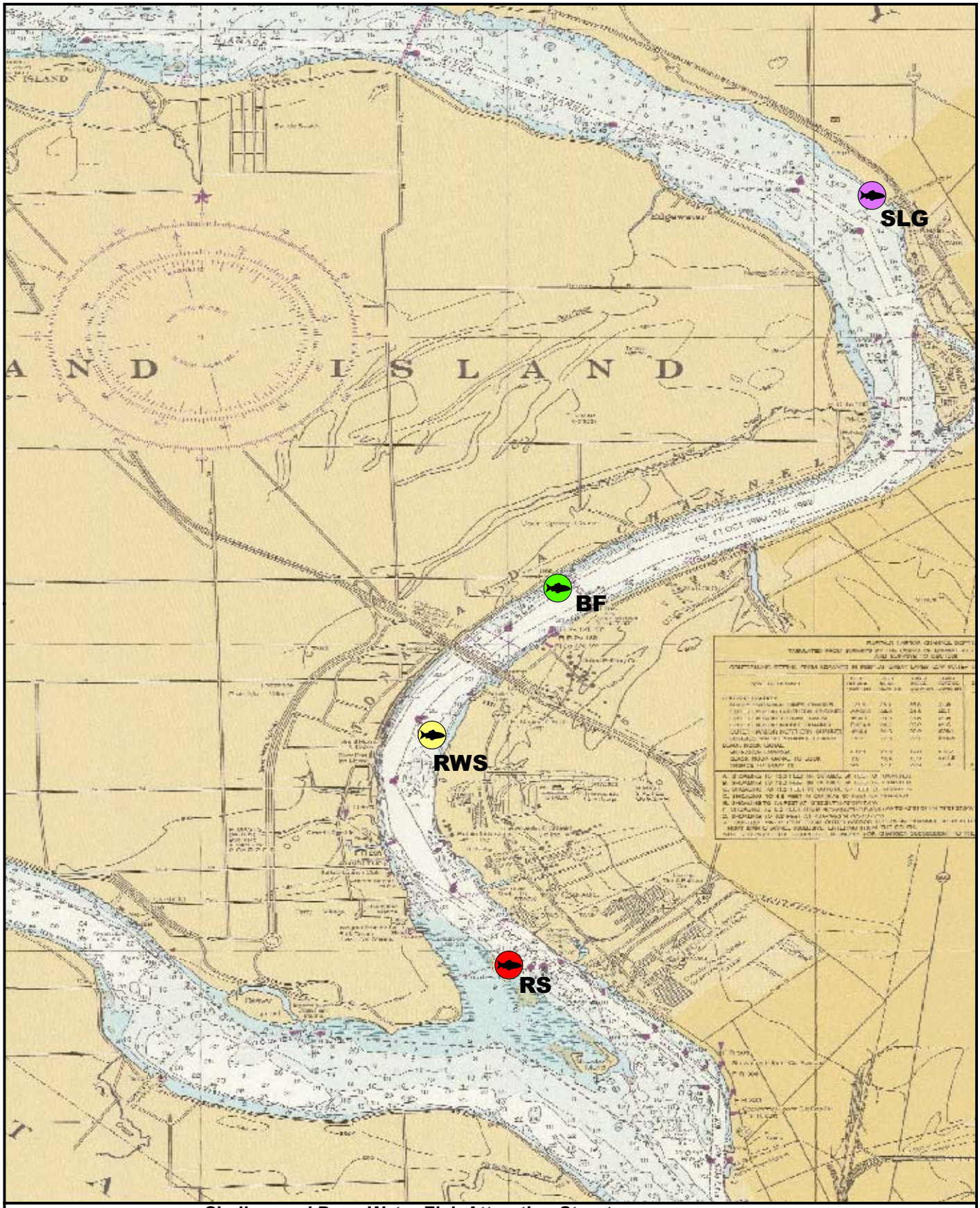
each of the four installation locations. Survey dives took approximately 20 to 30 minutes each at each location.

During each survey, divers from Riveredge Associates and NYPA visually observed the physical condition of the structures to characterize their structural integrity. Additional ancillary observations included presence or absence of fish, species observed and their relative abundance (*e.g.*, 0, 1-10, 11-20, 21-50, 51-100, >100), how the habitat changes over time (*e.g.*, sedimentation around the structures, zebra mussels clogging the interstitial spaces between the boulders, etc.), and other pertinent observations. An Aqua-Vu camera linked to a digital video recorder and flat panel monitor was used to provide real-time video images to observers on the dive support boat, as well as to document condition of the structures and any observed use by fish. Underwater still photos were also taken. A data sheet was completed by the divers and boat observers immediately following each survey dive (Appendix A).

Monitoring occurred at the four fish attraction structures constructed at the locations shown in Figure 1 and listed in Table 1.

TABLE 1. FISH ATTRACTION STRUCTURES MONITORED IN 2009

	Structure Coordinates North American Datum of 1983 (NAD83)	
Shallow Water (Gratwick Park)	**Latitude**	**Longitude**
Stone and Log Groin	43º 02' 55.0" N	78º 53' 38.0" W
Deep Water Locations		
Boulder Field	43º 00' 21.6" N	78º 55' 40.9" W
Rock Wing “Saddleback”	42º 59' 24.0" N	78º 56' 30.0" W
Rock Slope	42º 57' 54.0" N	78º 56' 00.0" W



Shallow and Deep Water Fish Attraction Structures
(Revised August 27, 2008)

Legend

- BF — Boulder Field
- RS — Rock Slope
- RWS — Rock Wing "Saddleback"
- SLG — Stone and Log Groin

N

1 inch = 1 mile

NIAGARA POWER PROJECT

New York Power Authority

Revised August 27, 2008

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4.0 RESULTS

Each fish attraction structure was visited over the course of two days in late September 2009. Observations were recorded on the field data sheets included in Appendix A, and are summarized in Table 2. Weather during the monitoring activities ranged from clear to cloudy, with an average water temperature of 20.3°C. The average time of observation at each structure location was 21.5 minutes, with observation times ranging from 19 to 24 minutes. Visibility was best on the first day of observation, allowing divers to see 6 to 10 feet at the Rock Slope structure at Motor Island. Visibility at the remaining sites was somewhat lower on September 24th, only allowing divers to see distances less than 5 feet.

4.1 Physical Condition

Generally all of the sites were in good condition with none of the structures experiencing noticeable shifting of the rock used in construction. Where exposed to the current, the rocks were clean, but in sheltered areas the rocks were typically partially coated with silt and fine sediment, which was expected (Figure 2). Embeddedness (the degree to which small particles fill in the spaces around larger rocks), was higher at the Stone and Log Groin structure, where sand and zebra mussel shells had accumulated in the voids around the larger rocks. Three of the structures provided beneficial velocity breaks, as indicated by the decreased “flow through” observations, which can be used by fish for resting or ambush feeding behaviors. At the Rock Wing, substantial sediment accumulation occurred in the existing “saddle” area, where a long, low ridge comprised of shells, sand and gravel has developed, extending between the two larger piles of rock at the structure’s ends. In the Boulder Field, minor undercutting was observed around the upstream and lateral base of many of the boulders; material was subsequently deposited downstream of each boulder.

In general, logs used within the structures appeared to be in good condition with little to no damage from decomposition or shifting observed. However, one log at the Stone/Log Groin structure, which had originally been cabled in place and partially covered with rock, had been shifted several yards downstream and off of the structure, possibly due to ice. Although the rock holding the log has shifted, the cabling attached to the log appeared to be intact.

TABLE 2. SUMMARY OF 2009 MONITORING RESULTS.

Observation	Attraction Structure			
	Rock Slope	**Rock Wing**	**Boulder Field**	**Stone/Log Groin**
Location	Motor Island	Upstream S. Grand Island Bridge	Downstream S. Grand Island Bridge	Gratwick Park
Date	9/23/2009	9/24/2009	9/24/2009	9/24/2009
Time Started	15:40	09:15	10:50	12:30
Length of Observation (min)	20	24	19	23
Weather	Clear	Cloudy	Cloudy	Cloudy
Water Temp (º C)	21	20.1	20.1	20.1
Visibility (Ft)	6 to 10	<5	<5	<5
Method	Divers	Divers	Divers	Divers
Structure Condition	No change to structure	Low ridge partially filled in; also upstream pile is gathering sediment	Sediment accumulation downstream; lots of zebra mussel shells	Ice may have moved one log off structure
Embeddedness	Coating of silt on everything	Saddle has partially filled in and now low ridge of sediment	Some undercutting in front of boulders	Debris/cans abundant in spaces between rocks, and downstream
Boulder Shift	None	None	None	None
Logs	Good Condition	Good condition	Good condition	One log moved
Fouling	Algae	Debris, trash	Algae	Debris
Flow Through *(relative to upstream/ downstream conditions)*	Uniform (Slow)	Decreased	Decreased	Decreased
Fish Present	Yes	Yes	Yes	Yes
Smallmouth Bass (Adult)	11 to 20	51 to 100	21 to 50	11 to 20
Smallmouth Bass (Juvenile)	1 to 10	51 to 100	11 to 20	11 to 20
Gobies (Juvenile)	51 to 100	11 to 20	1 to 10	11 to 20
Comments	Juvenile smallmouth bass down in structure; several adult smallmouth bass holding above structure	Lots of fish!; vegetation growing in places along downstream end; structure breaking current as designed	Sediment accumulation downstream from each boulder	Wild celery establishing around edges of structure

Fouling of the structures was primarily a result of algal build up or debris (small woody debris, as well as aluminum beverage cans and plastic trash). Wild celery, a type of submerged aquatic vegetation that provides valuable habitat, was observed growing around the edges of the Rock Wing and Stone/Log structures.

Distinct velocity breaks were observed at most structures, particularly at the Rock Wing where currents went from several feet per second on the upstream side to near-zero in the lee, and adult smallmouth bass were observed holding in and foraging from these areas. The Rock Slope was the only site where a velocity decrease was not observed - current around the structure remained uniformly slow relative to upstream and downstream conditions.

FIGURE 2. REPRESENTATIVE VIEW OF SUBSTRATE TAKEN AT THE STONE/LOG GROIN STRUCTURE

4.2 Structure Utilization

Fish, primarily smallmouth bass and round gobies, were observed at all four structures at various densities and age classes (Figure 3). Smallmouth bass were the predominant species observed at all structures with the exception of the Rock Slope, where more gobies were

observed than smallmouth bass. Juvenile smallmouth bass were observed using the cover provided by the spaces between the rocks at the structures. Adult smallmouth bass were also observed using the logs at the structures as cover. The Rock Wing structure appeared to have the largest quantities of smallmouth bass. Gobies, an invasive species, were prevalent at the Rock Slope, and to a lesser degree in the undercut areas beneath the rocks in the Boulder Field. Live zebra mussels, another invasive species, did not appear to be widespread; however, empty shells were abundant in gravely areas, particularly at the Rock Wing and Boulder Field structures.

FIGURE 3. SMALLMOUTH BASS OBSERVED AT THE STONE/LOG GROIN STRUCTURE

5.0 DISCUSSION

Based on the results of the 2009 monitoring effort, the fish attraction structures appear to be in good condition and are working as designed, providing good large-object cover for fish in the Niagara River. With one minor exception, the physical integrity of the structures was not noticeably affected by shifting of boulders or logs within the structures. The only shifting noted was at the Stone/Log Groin structure, where ice may have moved a single log from its original

location. This log is still present, but has been moved several yards downstream, off the top of the stone structure. Deposition of silt and sediment has occurred downstream in areas where velocity was reduced, as expected and desired, creating substrate diversity within and behind the structures themselves. Minor scour and undercutting was noted around the upstream and lateral bases of the boulders at the Boulder Field. In general, fouling of the locations was minor, and was primarily from debris (sticks and aluminum beverage cans).

Prior to construction of the structures, few, if any fish were observed at these locations, and their use after the first year indicates that habitat at these locations is much improved. At all four locations, smallmouth bass in multiple age classes and at substantial densities, appeared to be using the structures and the water column just above them. Divers observed fish using the cover provided by the rocks and logs, as well as the velocity breaks that the structures created.

These results from the year one monitoring event indicate that the fish attraction structures are performing well. The next scheduled monitoring event will be conducted in year four (2012) to provide additional information on the physical condition and utilization of the fish attraction structures in the Niagara River.

7.0 REFERENCES

Kleinschmidt Associates and Riveredge Associates. 2005. Investigation of Habitat Improvement Projects for the Niagara Power Project, Niagara Power Project, FERC No. 2216 – Volume 1: Public. Prepared for New York Power Authority, White Plains, NY. August.

Kleinschmidt Associates. 2009. Fish Attraction Structure Monitoring Plan. Niagara Power Project, FERC No. 2216. Prepared for New York Power Authority, White Plains, NY. June.

APPENDIX A

2009 FIELD DATA COLLECTION FORMS

Niagara Power Project: Fish Attraction Habitat Improvement Project

Post-construction Monitoring Form

Date: (MM/DD/YY)	09/23/2009	**Time Started:**	15:40 ☐AM/ ☑PM
Location /Site:	☐ Stone/Log Groin @ Gratwick Park ☐ Rock Wing upstream SGI Bridge ☐ Boulder Field downstream SGI Bridge ☑ Rock Slope @ Motor Island	**Weather:**	☑Clear ☐ Rain ☐Windy ☐Cloudy ☐ Snow
Observer(s):	Lee Harper Dennis Dunning	**Length of Observation:**	20 minutes
Observer's Organization:	☑ NYPA/NYPA Contractor ☐ Other: _____	**Water Temperature:**	21.0°C
		Underwater Visibility (ft):	☐≤5 ☐10-25 ☐>50 ☑6-10 ☐25-50
Method of Observation:	☑ Divers ☐ Underwater Camera ☐ View Tube ☐ Other: _____		

Structure Condition:	Coating of silt on everything - structure appeared unmoved or undisturbed	
Embeddedness:	< %	☐ Cobble ☐Gravel ☐ Sand ☑Silt/Clay ☐ Zebra Mussels
Boulder Shifting:		☑ None Observed ☐ Minimal ☐ Moderate ☐ Substantial
Logs:	good condition cable OK	☐ Log decomposition ☐ Cable Failure ☐ Other *(describe)* some bark coming off
Fouling Observed:		☐ Debris ☑ Algae ☑ Anchor or Lines ☐ Fishing Gear ☐ Zebra Mussels ☐ Other *(describe)* _____
Flow through Structure: *(relative to upstream and downstream conditions)*		*(check all that apply)* ☑ Uniform ☐ Increased velocity ☐ Decreased velocity but slow ☐ Reverse current/eddies ☐ Still water

Fish Present at Structure:	☑ Yes ☐No		
Species Observations	**Estimated Abundance**	**Life Stage**	**Comments**
SMB	☑1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☑ Juvenile ☐ Adult	
Gobies	☐1-10 ☐21-50 ☐>100 ☐11-20 ☑51-100	☑ Juvenile ☐ Adult	
SMB	☐1-10 ☐21-50 ☐>100 ☑11-20 ☐51-100	☐ Juvenile ☑ Adult	Added 10-21-09 per Lee Harper + Dennis Dunning
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	

Photograph/Video File Number(s):	*(list individually or the start & end of range)* DVD disk dated and marked as Rock Slope

Activity Observed Near Structure *(Include any activity that may cause disturbance)*:

- On the offshore side at least one adult Smallmouth bass & a drum
- juvenile bass on the structure and lots of gobies
- 4-5 YOY smallmouth & 1 yearling were down in the structure
- 3-4 adults following divers and were "over" the structure
- Depth 10' - 13'

→ 10-21-09 per Dennis Dunning - current was relatively slow in area around and through the structure

Niagara Power Project: Fish Attraction Habitat Improvement Project

Post-construction Monitoring Form

Date: (MM/DD/YY)	09/24/2009	**Time Started:**	09:15 ☑AM/ ☐PM
Location /Site:	☐ Stone/Log Groin @ Gratwick Park ☑ Rock Wing upstream SGI Bridge ☐ Boulder Field downstream SGI Bridge ☐ Rock Slope @ Motor Island	**Weather:**	☐Clear ☐ Rain ☐Windy ☑Cloudy ☐ Snow
Observer(s):	Lee Harper Denis Dunning	**Length of Observation:**	24 minutes
Observer's Organization:	☑ NYPA/NYPA Contractor ☐ Other: _____	**Water Temperature:**	68.1 °F
		Underwater Visibility (ft):	☑≤5 ☐10-25 ☐>50 ☐6-10 ☐25-50
Method of Observation:	☑ Divers ☐ Underwater Camera ☐ View Tube ☐ Other: _____		

Structure Condition:	The low ridge is largely sedimented in - the upstream pile is also sediment par 10-21-09 gathering	
Embeddedness:	%	☐ Cobble ☐Gravel ☑ Sand ☐Silt/Clay ☑ Zebra Mussels
Boulder Shifting:		☐ None Observed ☐ Minimal ☐ Moderate ☐ Substantial
Logs: None		☐ Log decomposition ☐ Cable Failure ☐ Other *(describe)*_____
Fouling Observed:		☐ Debris ☐ Algae ☐ Anchor or Lines ☐ Fishing Gear ☐ Zebra Mussels ☑ Other *(describe)* lots can & sticks and other junk ~~that is getting trapped by the structure~~
Flow through Structure: *(relative to upstream and downstream conditions)*	*(check all that apply)* ☐ Uniform ☐ Increased velocity ☑ Decreased velocity ☐ Reverse current/eddies ☐ Still water	Decrease velocity on the downstream edge

Fish Present at Structure:	☐ Yes ☐No		
Species Observations	**Estimated Abundance**	**Life Stage**	**Comments**
Sm B	☐1-10 ☐21-50 ☐>100 ☐11-20 ☑51-100	☑ Juvenile ☑ Adult	Lots of fish every age & class
Cobie	☐1-10 ☐21-50 ☐>100 ☑11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	

Photograph/Video File Number(s):	*(list individually or the start & end of range)* DUD - marked as saddle back

Activity Observed Near Structure *(Include any activity that may cause disturbance)*:

- Really Cool! - Lots of fish
- Lots of zebra mussels & shells sediment Behind/downstream of Rocks
- Fish of every age & size class
- the saddle has filled in and is now just low ridge largely of sediment
- the upstream pile ~~has~~ is also sedimenting in
- Vegetation is growing in places along the downstream end

- structure doing exactly what it was supposed to do - break the current
10-21-09 Per Denis Dunning - Current was strong in area around structure

Niagara Power Project: Fish Attraction Habitat Improvement Project

Post-construction Monitoring Form

Date: (MM/DD/YY)	09/24/2009	**Time Started:**	10:50 ☑AM/ ☐PM
Location /Site:	☐ Stone/Log Groin @ Gratwick Park ☐ Rock Wing upstream SGI Bridge ☑ Boulder Field downstream SGI Bridge ☐ Rock Slope @ Motor Island	**Weather:**	☐Clear ☐ Rain ☐Windy ☑Cloudy ☐ Snow
Observer(s):	Lee Harper ~~Kalab~~ Caleb Basiliko	**Length of Observation:**	19 minutes
Observer's Organization:	☑ NYPA/NYPA Contractor ☐ Other: _____	**Water Temperature:**	68.1 °F
		Underwater Visibility (ft):	☑≤5 ☐10-25 ☐>50 ☐6-10 ☐25-50
Method of Observation:	☑ Divers ☐ Underwater Camera ☐ View Tube ☐ Other: _____		

Structure Condition: There is some accumulation of sediment just down stream - lots of zebra shells		
Embeddedness:	None %	☐ Cobble ☐Gravel ☐ Sand ☑Silt/Clay ☑ Zebra Mussels
Boulder Shifting:		☑ None Observed ☐ Minimal ☐ Moderate ☐ Substantial
Logs: None		☐ Log decomposition ☐ Cable Failure ☐ Other *(describe)*_____
Fouling Observed:		☐ Debris ☑ Algae ☐ Anchor or Lines ☐ Fishing Gear ☐ Zebra Mussels ☐ Other *(describe)* _____
Flow through Structure: *(relative to upstream and downstream conditions)*		*(check all that apply)* ☐ Uniform ☐ Increased velocity ☑ Decreased velocity ☐ Reverse current/eddies ☐ Still water Each boulder broke the current well

Fish Present at Structure:	☐ Yes ☐No		
Species Observations	**Estimated Abundance**	**Life Stage**	**Comments**
SmB	☐1-10 ☑21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☑ Adult	
Gobies	☑1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☑ Adult	
SmB	☐1-10 ☐21-50 ☐>100 ☑11-20 ☐51-100	☑ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	

Photograph/Video File Number(s):	*(list individually or the start & end of range)*

Activity Observed Near Structure *(Include any activity that may cause disturbance)*:

- SmB or the structure but not as much as the saddle Back
- definite sedimentation behind/downstream of each boulder
- some under cutting in front of rocks

10-21-09 - per Dennis Dunning current in area around structure was strong

Niagara Power Project: Fish Attraction Habitat Improvement Project

Post-construction Monitoring Form

Date: (MM/DD/YY)	09/24/2009	**Time Started:**	12:30 ☐AM/ ☑PM
Location /Site:	☑ Stone/Log Groin @ Gratwick Park ☐ Rock Wing upstream SGI Bridge ☐ Boulder Field downstream SGI Bridge ☐ Rock Slope @ Motor Island	**Weather:**	☐Clear ☐ Rain ☐Windy ☑Cloudy ☐ Snow
Observer(s):	Lee Harper Kaitab Dennis Duming	**Length of Observation:**	23 minutes
Observer's Organization:	Caleb Basiliko ☑ NYPA/NYPA Contractor ☐ Other: _____	**Water Temperature:**	68.1 °F
		Underwater Visibility (ft):	☑≤5 ☐10-25 ☐>50 ☐6-10 ☐25-50
Method of Observation:	☑ Divers ☐ Underwater Camera ☐ View Tube ☐ Other: _____		

Structure Condition:		
Embeddedness:	<5 %	☐ Cobble ☐Gravel ☑ Sand ☐Silt/Clay ☑ Zebra Mussels
Boulder Shifting:		☑ None Observed ☐ Minimal ☐ Moderate ☐ Substantial
Logs:	one log moved off the structure - Probably ice	☐ Log decomposition ☐ Cable Failure ☑ Other *(describe)*_____
Fouling Observed:		☑ Debris ☐ Algae ☐ Anchor or Lines ☐ Fishing Gear ☐ Zebra Mussels ☐ Other *(describe)* _____
Flow through Structure: *(relative to upstream and downstream conditions)*		*(check all that apply)* ☐ Uniform ☐ Increased velocity ☑ Decreased velocity Current Broken downstream ☐ Reverse current/eddies ☐ Still water

Fish Present at Structure:	☐ Yes ☐No		
Species Observations	**Estimated Abundance**	**Life Stage**	**Comments**
SMB	☐1-10 ☑21-50 ☐>100 ☑11-20 ☐51-100	☐ Juvenile ☑ Adult	
SMB	☐1-10 ☐21-50 ☐>100 ☑11-20 ☐51-100	☑ Juvenile ☐ Adult	
cobbles	☑1-10 ☐21-50 ☐>100 ☑11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	
	☐1-10 ☐21-50 ☐>100 ☐11-20 ☐51-100	☐ Juvenile ☐ Adult	

Photograph/Video File Number(s):	*(list individually or the start & end of range)* marked on Disk

Activity Observed Near Structure *(Include any activity that may cause disturbance)*:

- Debris and cans and sticks abundant in spaces
- a few sections of sediment downstream of structure
- location - just offshore of the end of the concrete
- Valisneria around the fringes of the pile

10-21-09 per Dennis Duming - Current was strong in area around structure