Browns Run, Warren County
COLDWATER CONSERVATION PLAN

Western Pennsylvania Conservancy
Fall 2011

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Founded in 1932, the Western Pennsylvania Conservancy (WPC) is a non-profit conservation organization that protects and restores exceptional places to provide our region with clean waters and healthy forests, wildlife and natural areas for the benefit of present and future generations. The Conservancy creates green spaces and gardens, contributing to the vitality of our cities and towns, and preserves Fallingwater, a symbol of people living in harmony with nature.

The WPC's Watershed Conservation Program protects and restores rivers, lakes and streams to provide our region with sustainable, clean water supplies that are critical to our quality of life and economy. We provide cost-free, comprehensive assistance to communities and local watershed groups, helping with project selection and prioritization, funding proposals and project management. We also partner with individual landowners and businesses to help them improve water quality and protect the environment on their properties. The Watershed Conservation Program has extensive expertise applying on-the-ground restoration activities since 2001.

Project Funders

This project was funded in part by a grant from the Coldwater Heritage Partnership on behalf of the PA Department of Conservation and Natural Resources, the PA Fish and Boat Commission, the Foundation for Pennsylvania Watersheds and the PA Council of Trout Unlimited.

INTRODUCTION

WPC, in partnership with the Warren County Conservation District, utilized the Coldwater Heritage Grant to gather much-needed information about the Browns Run watershed. Little information was previously available on the health and status of the aquatic resources of the Browns Run watershed, and no formal assessments had been done on its three Exceptional Value streams. WPC and partners believed that a focused study of the Browns Run watershed was appropriate and necessary. Baseline data on water quality and aquatic health were sorely needed in order to maintain and enhance the ecological and recreational values of the watershed and to help guide and measure the success of future restoration efforts. The study included a general visual assessment and fish assessment of Browns Run, Morrison Run and Dutchman Run. The ultimate goal of the plan was to address issues and recommendations developed by the local public, municipalities, conservation organizations, and government agencies active within the watershed. The Western Pennsylvania Conservancy is committed to the success of this plan, and will be available to assist local stakeholders as they utilize the plan to work towards protection and restoration of the Browns Run watershed and its three Exceptional Value streams.

BROWNS RUN CHARACTERISTICS

Watershed Overview

Located within Mead and Pleasant townships near the City of Warren in Warren County, the Browns Run basin contains nine named and unnamed tributaries traversing a total of 30.7 stream miles. The three main tributaries include Browns Run, Morrison Run, and Dutchman Run. Greater than 50% of the watershed lies within the Allegheny National Forest and is open to public fishing (Figure 1).

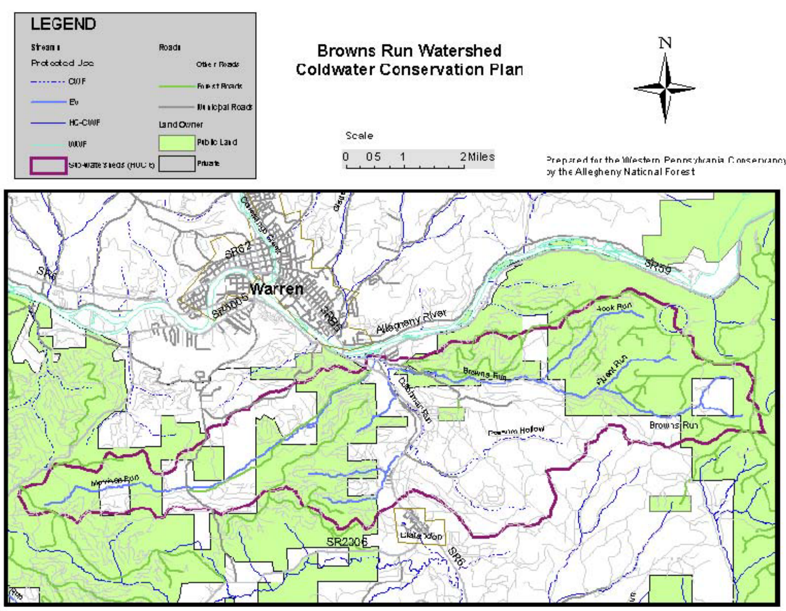

Figure 1. Browns Run Watershed

Physiography, Topography, and Geology

Physiographic regions are broad-scale subdivisions of the land surface based on terrain texture, rock type, and geologic structure and history. The Browns Run watershed is located within the northern portion of the High Plateau Section of the Appalachian Plateaus Province, characterized by broad, rounded to flat uplands having deep angular valleys.

The topography of the section consists of moderate to high relief, with elevations ranging from 980 to 2360 ft.

The watershed is underlain by open folded sandstone, siltstone, shale, and conglomerate with some coal. The origin of the materials and their structure is contributed to fluvial erosion and periglacial mass wasting, which formed the area (PADCNR).

Land Use

Intensive oil and gas extraction is occurring throughout the forested areas of the basin. Agricultural and cleared land is the second-largest land use, accounting for 22% of the land in these townships. A small section of Dutchman Run near the Village of Clarendon is considered impaired. Other than 2 small commercial properties, no major industries are present within the basin. Both PA State Route 6 and the Penn Central Railroad bisect the watershed in a north/south direction, with the basin's residential area tending to be grouped along PA State Route 6. In the 1990 census, the population of Mead Township was 1,579 and Pleasant Township was 2,663. It is estimated that the Browns Run basin contains approximately 486 people, with the vast majority residing in Mead Township. Access throughout the watershed is made possible by township roads, forest roads, and state highways, which are located along the valley bottoms adjacent to the creeks. Basin elevations range from 1,180 feet to 2,060 feet. No portion of the Browns Run basin possesses attributes that qualify as outstanding, national, state, regional, or local resource waters under Pennsylvania Department of Environmental Protection (DEP) regulatory criteria.

Permitted Discharges

There were four permitted National Pollutant Discharge Elimination System (NPDES) discharges within the basin (Appendix C) at the time of the study. Permitted facilities included the Church of Jesus Christ of Latter Day Saints in Mead Township, which discharged to Morrison Run (Permit 9PA0101311). This facility was permitted for 0.0018 mgd. Permit #PA0102342 was issued to the Penn View Motel in Mead Township, which discharged to Morrison Run. It had an average monthly discharge limit of 0.00148 mgd. The Wilderness Mobile Home Park in Pleasant Township, which also discharged to Morrison Run, had a permitted average monthly flow of 0.02 mgd. The Fox Trailer Court in Mead Township discharged an average of 0.0077 mgd to unnamed tributary 56500 to Dutchman Run. Pennsylvania American Water Company was the only permitted municipal surface water withdrawal present within the basin, withdrawing water from Morrison Run (PADEP 2001).

Trout

The three main streams—Browns Run, Morrison Run and Dutchman Run—are classified as Exceptional Value (EV) streams and hold populations of naturally reproducing native brook trout. The watershed is an important tributary to the middle Allegheny River watershed, which is rich in aquatic resources, including threatened and endangered mussel species. Although no portion of Browns Run is a Class A Wild Trout Stream or a Wilderness Trout Stream, it is an approved trout water, allowing for the stocking of trout and public fishing access at many sites (Pennsylvania Fish and Boat Commission [PAFBC 2011]). The stocking of rainbow trout, along with ample public access and proximity to the population center of the City of Warren, make the three streams important recreational fisheries (PADEP 2001).

Figure 2: Brown trout sampled in Browns Run, July 2008

Previous Studies of Watershed

Browns Run was surveyed first in 1994 by DEP in response to a request by PFBC that the water be re-designated a High Quality Cold Water Fishery (HQ-CWF). However, concern by the local community aroused objections in regards to the potential effects the Exceptional Value (EV) water designation would have on the local economy (PADEP 2001). The Environmental Quality Board (EQB) held a public hearing to accept comments on the proposed re-designation on July 1, 1997 (EQB 1997). As a result of the hearing, DEP agreed to resurvey Browns Run. This reevaluation was conducted June 2–June 4, 1998 at 12 stations in the Browns Run basin (Appendix A) to reevaluate the watershed's High Quality status. No long term water quality data were available to allow for a direct comparison.

Grab samples were collected at the stations during the June survey (Appendix B). Results from these samples showed elevated levels of cadmium (Cd) at Station 12MR, copper (Cu) at Station 11UT, and alkalinity levels below 20 mg/l at 5 of the headwater stations. The low alkalinities were attributed to natural geologic conditions and possible impacts from acid precipitation. Bacteriological sampling revealed fecal coliform levels ranging from 10 to 12,000 colonies/100 ml. All stations yielding high coliform counts contained a significant quantity of residential development upstream of the sampling site which may have been responsible for the high bacterial levels (DEP 2001).

The indigenous aquatic community is a better indicator of long term conditions and is used as a measure of ecological significance. During the June 1998 survey, habitat and biological assessments were collected at 13 locations using a modification of EPA's Rapid Bioassessment Protocol III (Barbour et. al 1999). The data gathered at Browns Run stations were compared to three stations within the East Hickory Creek watershed in Warren County. An evaluation of physical habitat assessments for these stations revealed that the majority of the sampling stations possessed optimal habitat for benthic macroinvertebrates and fish (8 stations) with a lesser number (5 stations) possessing suboptimal habitat (Appendix D). All Browns Run reference stations received optimal habitat scores. Scoring parameters included amount of adequate riparian zone, vegetative disruptive pressure, and limited velocity/ depth regimes, the latter receiving the lowest score in the basin. Benthic macroinvertebrate samples were collected from the best available habitat at 13 stations in the Browns Run basin (Appendix E). Most stations without obvious habitat or nutrient enrichment problems exhibited tremendous taxa richness. The number of Ephemeroptera, Plecoptera, and Tricoptera (EPT) genera present at these stations varied from a low of 2 at Station 9UT to a high of 20 at Station 2FR. The total taxa numbers for the reference stations ranged from 35 to 41. The number of EPT taxa in these reference samples varied from 14 to 19. Waters in all portions of the basin were found to support their designated uses except for two unnamed tributaries to Dutchman Run which were considered impaired based on the benthic macroinvertebrate community and the physical habitat. Since 1963, the fish population in the mainstem of Browns Run has been surveyed by PFBC, the United States Fish and Wildlife Service (USFWS), and DEP (Appendix F). The USFWS assessed the fish assemblage in 1963. They found six species including brown and brook trout 1.5 miles upstream of the mouth. In 1980, USFWS compiled all the fish data from 1963-80 for a catchable trout evaluation. This list was comprised of ten species which included brown, brook, and rainbow trout. In 1980 and 1989 the PFBC electrofished Browns Run above the confluence with Dutchman Run. Again, three trout species were collected along with several species of dace, suckers, darters, and a sculpin species. The DEP's latest electrofishing effort occurred April 26-28, 1994. Six stations were electrofished yielding a total of ten species. Brown trout were collected from five of the stations and Brook trout were present at four stations. Natural reproduction was evident throughout the basin. Brook trout ranged in size from one inch to approximately seven inches, while brown trout ranged from one inch to approximately eighteen inches. Several parameters were scored at each station for a RBP metric comparison (Appendix G). Parameter scores resulted in a total biological condition score.

Upon the reevaluation, the DEP report was not changed from the original decision. Based on biological condition scores greater than 92%, DEP maintained its recommendations of Exceptional Value designation for the majority of the basin, including 11.8 miles of the Browns Run basin, 4.5 miles of the Dutchman Run basin, 1.4 miles of the unnamed tributary to Dutchman Run, and 6.9 miles of the Morrison Run basin. The remainder of the basin, including a length of Dutchman Run and a length of Browns Run mainstem totaling 7.5 miles, was recommended to retain its CWF designation. DEP recommendations varied from the original request by PFBC of HQ-CWF for the entire basin (PADEP 2001). The EQB approved the proposed rulemaking on March 20, 2001 (EQB May 2001). With a public comment period that closed on June 19, 2001, a number of requests for another public hearing were responded to with another hearing scheduled for September 4, 2001 (EQB July 2001). A total of 52 commentators were received, with 37 opposing comments similar to those heard at the previous hearing. Since the EV designation was based solely on the quality of the water, No changes were made to the proposed rulemaking following the public comment period (EQB 2003).

METHODS

The study included a general visual assessment and fish assessment of Browns Run, Morrison Run and Dutchman Run. The assessments were completed in a modified format of the EPA Rapid Bioassessment Protocols (RBP) (Barbour et. al 1999). Sites were selected primarily on public land by working closely with the Allegheny National Forest, as well as the Cornplanter Chapter of Trout Unlimited. The recorded sites will become permanent monitoring sites to assess water quality and aquatic health over a longer term.

Visual Assessment Methods

A visual based habitat assessment modeled after EPA protocols, was applied on Browns Run. The stream was observed in 3 segments, separated by confluences with tributaries. To assess physical quality of the watershed, stream characterization parameters including stream type and origin were observed. Watershed features, such as surrounding land use, local watershed pollution and erosion were examined. Riparian vegetation was noted. In-stream features examined included stream reach, width, depth and velocity along with canopy cover, high water mark, proportion of stream morphology types, channelization and obstructions present. Water quality parameters were examined including conductivity, pH, and turbidity. If observed, water odors and surface oils were documented. Sediment and substrate characteristics were also documented.

To assess the quality of habitat, a visual evaluation was conducted of the variety and quality of the substrate, channel morphology, bank structure, and riparian vegetation. Habitat parameters pertinent to the assessment of habitat quality included those that characterize the stream "micro scale" habitat (e.g., estimation of embeddedness), the "macro scale" features (e.g., channel morphology), and the riparian and bank structure features that are most often influential in affecting the other parameters (Barbour et. al 1999).

Fish Sampling Methods

Fish sampling was conducted at a minimum of five sites in each stream. Four individual 300-ft. transects were electrofished on two separate dates in Browns Run from June to September of 2008 (Figure 3). Hook Run was electrofished at three separate transects on June 27, 2008. Fluent Run was electrofished at two transects on July 21, 2008. Morrison Run was electrofished August 26, 2008 at one transect.

Figure 3: Browns Run fish populations were sampled by electrofishing, July 2008.

RESULTS

Visual Assessment Results

Surrounding land use and visual observations of Browns Run varied drastically from the headwaters to the lower reaches and confluence with the Allegheny River. Although roadways, oil and gas extraction, and timbering represent the potential sources of nonpoint source pollution in the majority of the Browns Run basin, none of these activities appeared to be significantly impacting overall water quality from the sampling and assessment performed. Rather, problems such as sediment deposition and lack of a riparian zone occur along the more developed Route 6 corridor occurred as a result of increased population density. The potential exists for movement of road salt and toxics into the stream in areas of bridge overpasses.

The headwaters consisted primarily of a forested riparian area with minor influence by residential areas and oil and gas development (figure 4). Road influence was present with both a paved road and a gravel road paralleling the stream’s left bank. However, most areas maintained a safe riparian zone buffer between road and stream.

Erosion was minimal. Stream reach, width, depth and velocity were typical of the stream type. Proportion of stream morphology types was optimal with all velocity/depth regimes present. No obstructions were present in this reach but channelization occurred in the form of a bridge fording Browns Run Road. However, the bridge was over 20 years old, limiting its impact on current stream conditions. There also existed a dirt and gravel road crossing farther upstream in the headwaters. No water odors or surface oils were observed. Habitat parameters were optimal with minimal embeddedness of substrate. Channel morphology, bank structure, and riparian vegetation were adequate of macroinvertebrate colonization and fish habitat requirements.

Figure 4: The headwater segment of Browns Run exhibited minor influence from the oil and gas industry and residential areas. However, most of the stretch maintained optimal conditions.

The reach of Browns Run from Dutchman Run to Morrison Run consisted primarily of a constricted riparian zone with land use dominated by residential impact along both banks. Although residential development was present along the left bank, it was buffered by a safe riparian zone width dominated by shrubby vegetation. Road influence was moderate with paved roads present on both banks of the stream. Erosion was minimal along the left bank while the right bank was moderately eroded due to the close proximity of residential activity. Stream reach, width, depth and velocity were typical of the type and gradient of the stream. Proportion of stream morphology types was suboptimal due to lacking riffle and pool regimes. No obstructions were present in this reach but channelization occurred in the form of a bridge. However, the bridge was over 20 years old, limiting its impact on current stream conditions. Bank revetments existed in the form of riprap lining a minor portion of the stream banks. No water odors or surface oils were observed. Habitat parameters were suboptimal with moderate embeddedness of substrate. Although riparian vegetation and bank structure was not poor, channel morphology lacking riffle created less than ideal conditions for macroinvertebrate colonization and fish habitat requirements.

Figure 5: The Dutchman to Morrison segment of Browns Run exhibited residential development on both banks.

The reach of Browns Run from Morrison Run to the mouth consisted primarily of a constricted riparian zone with land use dominated by residential and industrial activity. Road influence was major with a high traffic paved road present on the left bank of the stream, highly restricting the riparian zone width and connectivity to flood plain. Erosion was moderate along both banks with the left bank affected more severely due to the close proximity of the road. Stream reach, width, depth and velocity were typical of the stream gradient and type with large deep pools characterizing this reach. Bank revetments existed in the form of riprap lining a minor portion of the stream banks. No water odors or surface oils were observed. Habitat parameters were marginal with significant embeddedness of substrate. Channel morphology was considered to be typical of the lower reaches of a stream of this type, with large deep pools supporting fish habitat requirements. However, it came at the cost of much siltation of stream substrate, negatively effecting macroinvertebrate colonization. With highly eroded banks, scarce vegetation dominated by invasive Japanese knotweed, bank structure and riparian vegetation zone parameters were less than ideal for macroinvertebrate colonization and fish habitat requirements.

Figure 6: The reach of Browns Run from Morrison Run to the mouth consisted primarily of a constricted riparian zone with land use dominated by residential and industrial activity.

Water Quality Results

Overall, water quality in Browns Run was found to be well within the limits of supporting most forms of aquatic life.

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic or organic dissolved solids. Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows although discharges to streams can also alter measurements. Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 µhos/cm. Conductivity of rivers, specifically, in the United States generally range from 50 to 1500 µmhos/cm (EPA Feb. 2010). Given this, conductivity measurements were within an acceptable range. The conductivity of Browns Run headwaters averaged 70 µmhos/cm. The reach of Browns Run from Dutchman Run to Morrison Run averaged 144 µmhos/cm. The reach of Browns Run from Morrison Run to the mouth averaged 168 µmhos/cm.

pH is an expression of hydrogen ion concentration in water used to indicate the degree of alkalinity or acidity of a solution ranked on a scale of 0 to 14, with pH 7 being neutral. Most chemical and biological processes in water are affected by pH, and it is one of the most important environmental factors limiting the distribution of species in aquatic habitats. U.S. EPA water quality criteria for pH in freshwater suggest an optimal range of 6.5 to 9 (EPA Sept. 2010). Average pH measurements were optimal with slightly basic measurements. The Browns Run headwaters averaged a pH of 7.6. The reach of Browns Run from Dutchman Run to Morrison Run averaged a pH of 7.9. The reach of Browns Run from Morrison Run to the mouth averaged a pH of 7.9.

Fish Sampling Results

Brook trout are found in Pennsylvania as wild populations in the Ohio, Susquehanna, Genesee, Potomac and Delaware River watersheds as well as throughout the state as hatchery-raised, stocked fish. Despite its status as Pennsylvania's state fish, the habitat of wild brook trout has been greatly reduced in Pennsylvania since European settlement, with land-use changes leading to pollution and stream habitat degradation. Naturally self-sustaining populations can still be found in cold mountain creeks (Steiner 2000). The Browns Run watershed maintains populations of Brook trout, prioritizing need for conservation of the watershed and the Brook trout species.
An even age class distribution was found to exist within Browns Run, with Brook trout specimens occupying each size class from 25mm to 150mm. Within Hook Run, only 1 Brook trout in the 25 mm size class was collected. However, 33 Brook trout were collected in the 100 mm range, resulting in the largest quantity of 100 mm ranging fish of all sites sampled. Within Fluent Run, a total of 34 Brook trout were collected with the most populated size class being 100 mm. Within Morrison Run, a total of 33 Brook trout were collected with the 100 mm size class being the most populated range. Dutchman Run sampling produced well distributed but low quantity results in all size classes (Table 1).

Figure 7: Brown trout sampled in Browns Run, July 2008

The lower number of Brook trout sampled in Dutchman Run, when compared to the results sampled from other stretches of the watershed may have been due to the larger amount of private lands surrounding the Dutchman Run tributary. While the land use surrounding the other stretches of the watershed is largely comprised of national forest with regulations limiting development, the Dutchman Run tributary is largely comprised of private lands lacking such restrictions. The resultant population body and land use may be hindering the ability of the stretch to provide the proper water quality and habitat requirements for Brook trout colonization.

Although high numbers of Brook trout were sampled in the upper reaches of Browns Run, Hook Run, and Morrison Run, lower numbers were sampled in Fluent Run which is also a headwater reach lacking development. This impedes the formulation of a theory that headwaters of the Browns Run watershed are more populated due perhaps, to less degradation.

DISCUSSION

Watershed Improvement Needs and Solutions

There exists a need in the lower reaches of Browns Run for streambank stabilization and habitat improvement projects. In the reach from Dutchman Run to the confluence with the Allegheny River, the watershed would benefit from the installation of stabilization devices to reduce streambank erosion. While the use of rip rap, gabions, and concrete-lined streambanks do add stability, they offer little benefit to the aquatic habitat and environment (Lutz 2007). A variety of more natural techniques, such as mudsill cribbing, log faced stone deflectors, root wad placement, and growth of a riparian zone, would minimize erosion while improving the habitat suitability of Browns Run. Riparian buffers may be established through planting of native shrubs and trees or by simply allowing an area to grow naturally, allowing natural succession to determine vegetative composition. Although a forested buffer provides the most benefits and should be promoted whenever possible, a native shrub and/or grass community may be more suitable in an area of populated land use, such as the lower reaches of Browns Run. Buffer width should be a minimum of 35 feet in areas of limited use. However, in the populated lower reaches of Browns Run, which may be routinely mowed for aesthetic reasons, a minimum five foot buffer of dense vegetation should be planted along the bank (Lutz 2007).

The watershed would benefit from habitat improvement projects to benefit all age classes of trout by providing or preserving resting and hiding areas along with spawning, nursing, and foraging areas. This is achieved by encouraging diversity in habitat improvement structures. The installation of devices, such as deflectors, log vanes, water jacks, and random boulders, may be used to return natural velocity and depth regimes to Browns Run, encouraging colonization by both macroinvertebrate and fish species.

Figure 8: In the Browns Run reach from Dutchman Run to the confluence with the Allegheny River, the watershed would benefit from the installation of stabilization devices to reduce streambank erosion.

Projects

A larger restoration project is planned for the Brown's Run watershed by the Allegheny Watershed Improvement Needs and Solutions (WINS) Coalition. The Allegheny WINS Coalition is a group of like-minded non-profits, private individuals, and local, state and federal government agencies that focus efforts in watersheds entirely or partially within the Allegheny National Forest. The group established numerous projects throughout the Morrison Run subwatershed, with objectives to expand the range and number of native brook trout populations, eliminate fish passage barriers, decommission or improve two stream fords, reconstruct forest road portions to reduce sedimentation, and improve recreational opportunities throughout the drainage. The WINS coalition has been working toward these objectives since 2007.

There has been a continued effort since 2008 to install in-stream habitat improvement structures by Cornplanter Chapter of Trout Unlimited (CCTU), PFBC, U.S. Forest Service, WPC, and other partners. In September 2010, two log-faced stone deflectors and one modified mudsill were constructed by thirteen volunteers and employees in the headwaters of Morrison Run. Installation continued in September 2011 with the construction of one toe log-framed stone defector, one single-log vane deflector and one multi-log vane deflector by thirteen volunteers. Through the cooperation of CCTU, U.S. Forest Service and WPC, one dam located near the Route 6 entrance to Morrison Run near Warren was removed in October 2011 (figures 9,10). Along with the removal of the dam, a private bridge adjacent to the dam was replaced with a more adequate structure donated by the PA Game Commission. Funding for the project was provided by U.S. Fish and Wildlife Service in cooperation with PFBC. A total of 3 fish passage barriers, including the lower Morrison dam, have been removed since plan implementation.

Several other areas of concern (AOCs), which were identified by the WINS Coalition, remain. A dam in upper Morrison Run and another in Dutchman Run are in need of removal to open fish passage (figure 11). Replacement of a forest road crossing on Morrison Run is also targeted. The current culvert at Forest Road 156 has been identified by the WINS Coalition as insufficient due to annual flooding and the interference with aquatic organism passage. Another future project involves a train trestle that impedes aquatic organism passage at the lower end of Morrison Run. Due to a concrete slab on the streambed and severely narrowed channel at the immediate area of the trestle, aquatic organism travel is impeded by a stretch of high velocity, shallow water, which ends at a plunge pool. To address this problem, funding is being sought to construct a rock ramp downstream of the obstacle to raise water levels in the upstream problem area.

The Warren County Conservation District will use the protocols developed and refined during this Coldwater Heritage study to future supplement a larger watershed assessment of the Browns Run basin, including a sampling of other tributaries in the watershed that are expected to contain native brook trout populations. Project implementation is the next crucial step to ensuring the success of this plan. Individuals, landowners, business owners, municipalities, community and conservation groups, county, state, and federal agencies are all encouraged to play an active role in implementing management recommendations of the plan to improve the watershed and region. Western Pennsylvania Conservancy will continue to foster the partnerships that were forged throughout this planning process, and will remain available to assist with those implementation efforts.

Figure 9: Lower Dam, Morrison Run
For over a century, the dam impeded natural stream flow and prevented upstream spawning of trout.

Figure 10: Morrison Run After Lower Dam Removal
Removal of the dam was just one of many planned projects on the watershed which contribute to the return to natural flow regimes. Photo credit: Mike Fidale, CCTU

Figure 11: The upper dam remains in Morrison Run with plans to remove it in a future project.

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Table 1.
Brook Trout Sampled, by Size

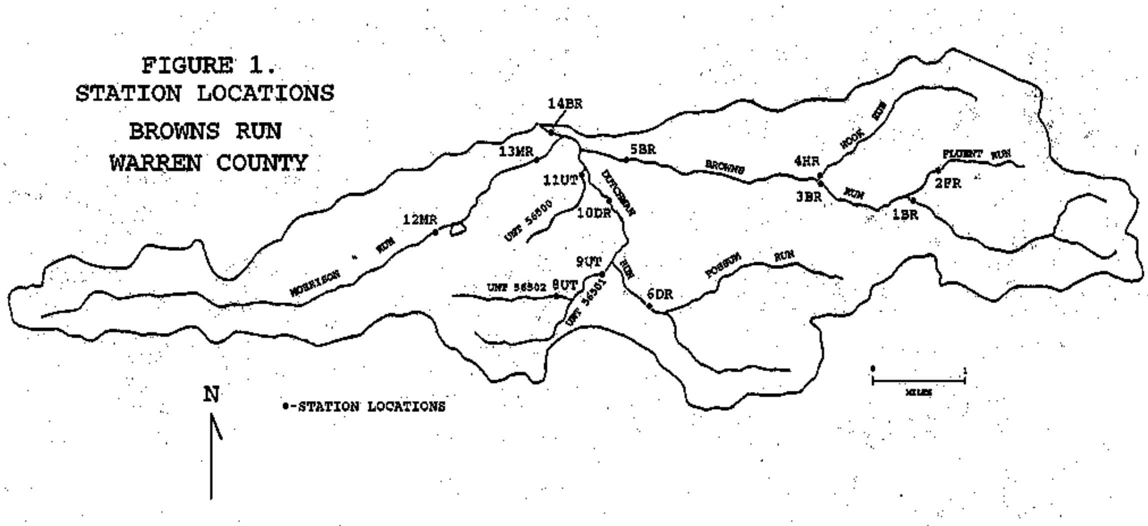
SITE	DATE	Transect (300 ft.)					
		1		2		3	
		SIZE CLASS (mm)	Quantity	SIZE CLASS (mm)	Quantity	SIZE CLASS (mm)	Quantity
Brown's Run	6.26.08	25	0	25	3		
		50	1	50	4		
		75	2	75	8		
		100	0	100	3		
		125	1	125	4		
		150	0	150	0		
		Total	4		22		
	7.22.08	25	0	25	0		
		50	1	50	3		
		75	0	75	2		
		100	1	100	4		
		125	0	125	4		
		150	0	150	6		
		Total	2		19		
Hook Run	6.27.08	25	0	25	1	25	0
		50	5	50	3	50	12
		75	5	75	13	75	9
		100	13	100	14	100	6
		125	10	125	6	125	8
		150	2	150	1	150	2
		Total	35		38		37

Table 1. (continued)

SITE	DATE	Transect (300 ft.)					
		1		2		3	
		SIZE CLASS (mm)	Quantity	SIZE CLASS (mm)	Quantity	SIZE CLASS (mm)	Quantity
Fluent Run	7.21.08	25	0	25	0		
		50	7	50	2		
		75	1	75	2		
		100	6	100	5		
		125	2	125	2		
		150	5	150	2		
		Total	21		13		
Morrison Run	8.26.08	25	0				
		50	8				
		75	4				
		100	10				
		125	6				
		150	5				
		Total	33				
Dutchman Run	9.16.08	25	0	25	0		
		50	2	50	0		
		75	3	75	0		
		100	1	100	0		
		125	3	125	0		
		150	3	150	0		
		175	1	175	0		
		200	1	200	0		
		Total	14		0		

Appendix A

Station Locations, Browns Run, DEP June 2008



Appendix B

Water Chemistry, Browns Run June 2-3, 1998

STATION	2FR	3BR	4HR	5BR	6DR	8UT	9UT	10DR	11UT	12MR	13MR	14BR
Field Parameters												
Temp (^{o}C)	10	10.5	10.1	11	11.6	10.7	12.4	12.8	15.8	12.4	14	15.8
pH	7.3	7.2	7.1	6.5	6.3	7.5	6.9	7.1	7.3	7.5	7.7	7.4
Cond (mmhos)	41	52	46	81	42	45	262	177	154	95	102	119
Diss. O_2	9.9	11.4	10.8	11.8	9.0	8.7	8.6	8.5	7.6	8.6	8.8	10.0
Laboratory Parameters												
pH	6.3	6.5	6.2	6.5	6.5	6.2	6.6	6.8	6.7	6.6	6.7	6.7
Alkalinity	8.2	13.8	6.6	17	26	7.2	34	40	40	24	30	28
Acidity	0	0	0	0	0	0.8	0	0	0	0	0	0
Hardness	14	14	15	22	16	14	55	44	29	21	24	28
T Diss. Sol.	34	30	28	36	150	36	180	102	90	54	62	70
Susp.Sol.	<2.0	<2.0	<2.0	<2.0	28.0	8.0	14.0	6.0	16.0	8.0	8.0	6.0
NH_3 -N	<.02	<.02	<.02	<.02	<.02	<.02	0.16	0.05	0.15	<.02	<.02	<.02
NO_2 -N	<.01	<.01	<.01	<.01	<.01	<.01	0.01	0.01	0.02	<.01	<.01	<.01
NO_3 -N	0.24	0.23	0.26	0.23	0.29	0.16	0.45	0.35	1.4	0.16	0.14	0.24
Total P	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.02	0.18	0.02	0.02	<0.02
Ca	3.39	3.69	3.12	5.66	6.24	3.46	18.5	14.2	12.3	6.01	6.96	8.9
Mg	1.57	1.54	1.58	2.20	2.60	1.65	5.31	4.56	4.45	2.17	2.69	3.18
Cl	1.0	2.0	3.0	6.0	3.0	2.0	58.0	19.0	10.0	7.0	9.0	10.00
SO_4	12	13	<10	11	<10	13	<10	<10	21	<10	11	11
As*	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
As Diss	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Cd*	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.71	< 0.2	< 0.2
Cd Diss	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Appendix B (continued)

hex Cr*	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cr*	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cu*	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	4.8	14.0	< 4.0	< 4.0	< 4.0
Cu Diss	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Fe*	90	162	112	126	560	217	1020	428	529	221	441	288
Pb*	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pb Diss	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mn*	10	15	12	12	35	26	271	52	120	28	35	29
Ni*	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Ni Diss	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zn*	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	8.6	7.7	6.4	6.5	< 5.0	8.4	< 5.0
Zn Diss	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	5.4	< 5.0	< 5.0	5.0	< 5.0	< 5.0	< 5.0
Al*	73.4	76.9	116	68.3	229	121	182	137	92.6	83.5	119	75.2
fecal coliforms	###	###	###	70	80	###	12000	1200	1500	###	10	340

[1]- Except for pH & conductance and indicated otherwise, all values are total concentrations in mg/L

· - Total concentrations in mg/L

Appendix C

NPDES Permitted Discharges, Browns Run

FACILITY NAME	PERMIT NUMBER	TOWNSHIP	COUNTY
Church of Jesus Christ of Latter-day Saints	PA0101311	Mead	Warren

TYPE OF DISCHARGE	PERMITTED FLOW
Sewage Permit	0.0018 mgd

LATITUDE	LONGITUDE	STREAM CODE AND NAME
41 49'13"	79 06'34"	56498 Morrison Run unnamed tributary

FACILITY NAME	PERMIT NUMBER	TOWNSHIP	COUNTY
Penn View Motel	PA0102342	Mead	Warren

TYPE OF DISCHARGE	PERMITTED FLOW
Sewage Permit	0.00148 mgd

LATITUDE	LONGITUDE	STREAM CODE AND NAME
41 49'10"	79 06'36"	56498 Morrison Run

FACILITY NAME	PERMIT NUMBER	TOWNSHIP	COUNTY
Wilderness Mobile Home Park	PA0101737	Pleasant	Warren

TYPE OF DISCHARGE	PERMITTED FLOW
Sewage Permit	0.02 mgd

LATITUDE	LONGITUDE	STREAM CODE AND NAME
41 48'05"	79 09'30"	56498 Morrison Run

FACILITY NAME	PERMIT NUMBER	TOWNSHIP	COUNTY
Fox Trailer Court	PA0030902	Mead	Warren

TYPE OF DISCHARGE	PERMITTED FLOW
Sewage Permit	0.0077 mgd

LATITUDE	LONGITUDE	STREAM CODE AND NAME
41 48'54.1"	79 06'11.8"	56500 Dutchman Run unnamed tributary

Appendix D:
Habitat Assessment Summary

Table 4

HABITAT PARAMETER		CANDIDATE STATIONS													REFERENCE[1]		
		1BR	2FR	3BR	4HR	5BR	6DR	8UT	9UT	10DR	11UT	12MR	13MR	14BR	R1	R2	R3
1.	instream cover	16	17	18	17	18	16	17	13	16	15	17	18	14	18	17	17
2.	epifaunal substrate	18	18	19	18	18	17	18	11	17	13	18	18	17	17	18	18
3.	embeddedness	17	16	17	15	16	13	16	9	16	9	16	17	16	18	17	17
4.	velocity/depth	14	14	17	16	17	14	14	12	14	12	13	14	14	14	15	16
5.	channel alterations	19	19	19	18	17	18	18	13	15	14	17	16	12	20	20	19
6.	sediment deposition	16	15	18	17	16	16	17	16	16	8	17	17	17	18	17	17
7.	riffle frequency	18	18	18	18	18	15	17	11	17	12	17	17	16	17	18	16
8.	channel flow status	13	13	13	13	12	14	12	17	14	13	12	14	14	13	14	14
9.	bank condition	17	16	17	15	17	16	14	14	11	14	14	16	15	17	18	16
10.	bank vegetation protection	17	17	18	16	17	16	15	15	12	15	16	16	16	18	19	17
11.	grazing/disruptive pressures	19	18	19	18	18	18	19	9	16	16	18	17	12	20	20	17
12.	riparian vegetation zone width	19	19	18	19	18	12	19	6	12	13	19	15	8	20	20	19
Total Score		203	200	211	200	202	185	196	146	176	154	194	195	171	210	213	203
Rating		OPT	OPT	OPT	OPT	OPT	SUB	OPT	SUB	SUB	SUB	OPT	OPT	SUB	OPT	OPT	OPT

Appendix E

Benthic Macroinvertebrate Result June 2-4, 1998

Table 5										
TAXA	**STATION (more . . .)**									
	1BR	**2FR**	**3BR**	**4HR**	**5BR**	**6DR**	**8UT**	**9UT**	**10DR**	**11UT**
Ephemeroptera (mayflies)										
Baetidae; ***Acentrella***	C	A	A	A	A	A		R		
Baetis				P	P					R
Ephemerellidae; ***Dannella***									R	
Drunella	P	P	C		C	A	P			
Ephemerella	P	A	C		A	A	C		C	P
Eurylophella		R								R
Ephemeridae; ***Litobrancha***	P									
Heptageniidae;***Epeorus***	C	C	A	R	A	A	VA			P
Heptagenia		C								
Stenacron	P									
Stenonema	C	P	P	R	P	P	P		C	R
Leptophlebiidae; ***Habrophlebioides***							P		P	P
Paraleptophlebia	R		C		R	R				
Siphlonuridae; ***Ameletus***							P			
Plecoptera (stoneflies)										
Chloroperlidae; ***Alloperla***			R		P					
Haploperla	R	P	R			R	C			
Sweltsa		C				R	R		R	
Leuctridae; ***Leuctra***	P	C	A	R	C	P	VA	R	P	
Paraleuctra										
Nemouridae; ***Amphinemura***	P	C	A	A	C	P	VA		R	P
Peltoperlidae; ***Peltoperla/Tallaperla***		P	R	R						
Perlidae; ***Acroneuria***			P	P	C	P	C			

Appendix E (continued)

Agnetina	P		P							
Perlodidae; ***Isoperla***	P	C	P		P	P	C			P
Pteronarcyidae; ***Pteronarcys***	R	A	P	P	P	R	P			
Tricoptera (caddisflies)										
Glossosomatidae; ***Agapetus***	P	P	P		P	P				
Hydropsychidae; ***Diplectrona***	P	A	C	A	P	C	C			P
Hydropsyche	C	P	P	P	A	A		P	A	P
Parapsyche							R			
Lepidostomatidae; ***Lepidostoma***	P	C	A	R	P		P			P
Limnephilidae; ***Pycnopsyche***	R	R		R						P
Philopotamidae; ***Dolophilodes***	A	A	A	P	A					
Wormaldia				R			P			
Polycentropodidae; ***Polycentropus***		P	P	R		R	R		R	
Psychomiidae; ***Lype***		R		R						
Rhyacophilidae; ***Rhyacophila***	P	C	P	R	P	P	C		P	
Uenoidae; ***Neophylax***					R	P	P			
Other Insect Taxa										
DIPTERA (true flies)										
Athericidae; ***Atherix***			C			R				
Ceratopogonidae	R	R	R					R		
Empididae; ***Chelifera***			R			P	P	R	P	
Clinocera										
Hemerodromia									R	
Muscidae								P		
Simuliidae; ***Prosimulium***							P			
Simulium	A	C	A		P	P	P	C		P
Tipulidae; ***Antocha***			R			P		P	P	
Dicranota	P	A	P		P	R	A	R		P

Appendix E (continued)

Hexatoma		P	R	R		R	P			
Limnophila						R	P			
Pseudolimnophila			R							
Tipula	R	R	R		R			P	R	P
Chironomidae	C	A	A	P	A	A	A	VA	A	VA
MEGALOPTERA										
Corydalidae; ***Nigronia***									P	
ODONATA (dragon-, damselflies)										
Gomphidae; ***Lanthus***	R	P	R	C			R			P
Gomphus										
COLEOPTERA (aquatic beetles)										
Dytiscidae; ***Agabus***										R
Elmidae; ***Optioservus***						P		R	P	
Oulimnius	P	A	C	C	P	A	VA			R
Promoresia		P	P		R					
Stenelmis								R		
Hydrophilidae										R
Psephenidae; ***Ectopria***		P	R			P	R			
Non-Insect Taxa										
Nematoda (round-worms)							R			
Bryozoa										
Oligochaeta					P	C	P	A	C	VA
Decapoda (crayfish)										
Cambaridae					R					
Cambarus	P		P	P		P	P		P	
Gastropoda (univalves, snails)										
Ancylidae; ***Ferrissia***						P				
Pelecypoda (bivalve clams)										
Sphaeriidae									R	R
Number of taxa in total sample	29	33	37	23	28	33	33	14	20	22

Appendix E (continued)

TAXA	STATION					
	12MR	13MR	14BR	R1	R2	R3
Ephemeroptera (mayflies)						
Baetidae; ***Acentrella***	P	A	C		A	P
Baetis	R	C	C	A	C	P
Ephemerellidae; ***Dannella***	R	R				
Drunella	A	A	P	A	P	A
Ephemerella	A	P	A	A	C	C
Serratella			C	P		A
Ephemeridae; ***Ephemera***				R	R	
Heptageniidae;***Epeorus***	C	A	P	C	C	A
Leucrocuta				C	R	
Stenacron					R	
Stenonema		P	P	C	C	C
Leptophlebiidae; ***Habrophlebioides***				P	C	P
Paraleptophlebia		A	R			C
Oligoneuriidae; ***Isonychia***					C	C
Plecoptera (stoneflies)						
Chloroperlidae; ***Alloperla***		R	R			R
Haploperla		P	R	R		
Leuctridae; ***Leuctra***	C	A	C		A	A
Paraleuctra				VA		
Nemouridae; ***Amphinemura***	C	C	P	C	P	P
Peltoperlidae; ***Peltoperla/Tallaperla***				R	R	
Perlidae; ***Acroneuria***	R	A	R	A	C	A
Agnetina					R	
Perlodidae; ***Isoperla***	C	P		P	P	C
Pteronarcyidae; ***Pteronarcys***			R			R
Tricoptera (caddisflies)						
Glossosomatidae; ***Agapetus***			P		P	C
Glossosoma				R		P
Hydropsychidae; ***Diplectrona***	P	A		A		P

Appendix E (continued)

Psephenidae; *Ectopria*		P				
Psephenus			P		P	P
Ptilodactylidae; ***Anchytarsus***						R
Non-Insect Taxa						
Oligochaeta	P	R	P			
Decapoda (crayfish)						
Cambaridae	R	P			R	
Cambarus			P	P		P
Gastropoda (univalves, snails)						
Ancylidae; ***Ferrissia***		P				
Number of taxa in total sample	25	32	37	35	38	41
VA = very abundant, > 99 organisms A = abundant, 25-99 organisms C = common, 10-24 organisms P = present, 3-9 organisms R = rare, < 3 organisms						

Appendix F

Fishes Collected, Browns Run Warren County June 2-4, 1998

SPECIES	ELECTROFISHING STATIONS: U. S. Fish & Wildlife Service		Pennsylvania Fish & Boat Commission				Dept. of Environmental Resources Stations April 26-28, 1994						
	8/63	1963 -1980	6/80	6/89 1	6/89 2	6/89 3	7/84	3 BR	4 BR	6 DR	10 DR	12 MR	13 MR
Brown trout	X	X	X	X	X	X		X		X	X	X	X
Brook trout	X	X	X	X	X	X	X	X	X	X		X	
Rainbow trout		X	X		X	X							
Bigeye chub	X	X									X		
Blacknose dace	X	X	X		X	X				X	X	X	X
Longnose dace	X	X	X										
Mottled sculpin	X	X	X	X	X	X	X	X	X	X	X	X	X
Creek chub		X			X	X					X		
White sucker		X	X			X					X		X
Fantail darter		X	X										
Johnny darter													X
Golden redhorse						X							
Black redhorse													X
Northern hog sucker						X							
Central stoneroller						X					X		

<u>United States Fish and Wildlife Service</u> -
8/63 - August 2, 1963 sampling station is located approximately 1.5 miles upstream of the mouth of Browns Run and extends downstream for 500 ft.
1963-1980 - 1980 Catchable trout evaluation - included species composition list for Browns Run from 1963 through 1980.

<u>Pennsylvania Fish and Boat Commission</u> -
6/80 - June 19, 1980 sampling of Browns Run. Section 01 limits include:
Station 1 - RMI 5.90, a 355 m length of stream which extends upstream from a jeep trail crossing Browns Run.
Station 2 - RMI 2.90, a 345 m section that originates 1 km downstream from Hook Run.
Station 3 - RMI 0.70, encompasses 366 m and originates 200 m upstream from the Route 59 bridge.
6/89 Section 01 sampled. Station locations for 1, 2, and 3 are the same as the PFBC June 1980 sample sites.

<u>Department of Environmental Resources</u> -
7/84 - PFBC, USFWS, and DER sampled 200 m upstream of mouth on Hook Run on July 19, 1984.

Remaining DER station locations are described on Table 1 and shown on Figure 1.

Appendix G

RBP Metric Comparison June 2-4, 1998

Table 8

METRIC		STATION															
		1BR	2FR	3BR	4HR	5BR	6DR	8UNT	9UNT	10DR	11UNT	12MR	13MR	14BR	R1	R2	R3
1.	TAXA RICHNESS	24	25	26	21	20	20	19	5	12	13	22	24	26	20	24	28
	Cand/Ref (%)	120	125	108	105	83	100	95	25	50	65	92	100	93	***	***	***
	Biol. Cond. Score	6	6	6	6	6	6	6	0	0	2	6	6	6	6	6	6
2.	MOD. EPT INDEX	17	19	16	15	16	12	12	0	5	7	11	15	13	12	13	16
	Cand/Ref (%)	142	160	123	125	123	100	100	0	38	58	85	115	81	***	***	***
	Biol. Cond. Score	6	6	6	6	6	6	6	0	0	2	6	6	6	6	6	6
3.	MOD. HBI	3.19	2.61	2.83	2.67	1.77	2.93	2.37	6.50	5.24	7.27	2.38	2.97	4.31	2.53	4.46	2.37
	Cand-Ref	0.66	0.08	-1.63	0.14	-2.69	0.40	-0.16	3.97	0.78	4.74	-2.08	-1.49	1.94	***	***	***
	Biol. Cond. Score	6	6	6	6	6	6	6	0	4	0	6	6	0	6	6	6
4.	% DOMINANT TAXA	24	18	19	25	16	20	25	82	38	43	17	22	33	25	42	20
	Cand-Ref	-1	-7	-23	0	-26	-5	0	57	-4	18	-25	-20	13	***	***	***
	Biol. Cond. Score	6	6	6	6	6	6	6	0	6	2	6	6	4	6	6	6
5.	% MOD. MAYFLYS	23	18	26	18	41	55	17	0	14	5	39	29	19	20	17	29
	Ref-Cand	-3	2	-9	2	-24	-35	3	20	3	15	-22	-12	10	***	***	***
	Biol. Cond. Score	6	6	6	6	6	6	6	4	6	4	6	6	6	6	6	6
TOTAL BIOLOGICAL CONDITION SCORE		30	30	30	30	30	30	30	4	16	10	30	30	22	30	30	30
% COMPARABILITY TO REFERENCE		100	100	100	100	100	100	100	13	53	33	100	100	73	***	***	***

NOTE:
Stations 1BR, 2FR, 4HR, 6DR, 8UT, 9UT, and 11UT compared to R1 Reference Station
Stations 3BR, 5BR, 10DR, 12MR, and 13MR compared to R2 Reference Station
Station 14BR compared to R3 Reference Station