Aquilla Reservoir Total Maximum Daily Load (TMDL) Implementation Plan Monitoring Project

Project No. 99-13 (TSSWCB)

Final Report

Texas Agricultural Experiment Station
And
Texas Cooperative Extension

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ABSTRACT

Aquilla Reservoir was assessed as not supporting its designated use when samples of finished drinking water violated the Maximum Contaminant Level (MCL) for atrazine. The MCL requires a running annual average of 0.003 mg/L or lower. The annual running average for the second quarter of 1997 through the first quarter of 1998 was 0.004 mg/L. This led to the listing of Aquilla Reservoir on the 1998 Texas 303(d) list and the subsequent development of a Total Maximum Daily Load (TMDL) for atrazine in the Aquilla Reservoir watershed. After the development of the TMDL, an implementation plan was prepared. Working with area farmers, state and federal agency personnel combined expertise and resources in order to more effectively deal with the atrazine issue. A major component of the implementation plan was the placement of best management practices (BMPs) designed to reduce off-target losses of atrazine in surface runoff. These BMPs included preplant incorporation of atrazine, use of grass filter strips, vegetated waterways, sediment control structures, and others. Cost-share programs of the USDA-Natural Resources Conservation Service (NRCS) and the Texas State Soil and Water Conservation Board (TSSWCB) helped fund installation of BMPs in the watershed. Texas Cooperative Extension (TCE) led the way in producer education on BMP effectiveness to enhance adoption by farmers. TCE and the Texas Agricultural Experiment Station (TAES) established and maintained a network of automatic and passive samplers in several locations of the watershed to collect runoff water generated by storm events. TCE and TAES also collected routine stream water samples and lake and stream sediment samples for analysis. The TAES pesticide fate research lab analyzed all samples for atrazine concentrations. This monitoring effort along with reservoir sampling by the Texas Commission of Environmental Quality (TCEQ) has been used to validate the effectiveness of BMP and educational efforts in reducing atrazine concentrations. 2003 and 2004 annual average atrazine concentrations from grab samples collected on a near monthly basis at several locations in the Aquilla Watershed showed a reduction in atrazine concentrations compared to 2001 and 2002 concentrations. Through this team effort, ambient atrazine concentrations for Aquilla Reservoir have been reduced by over 60% compared to 1997 – 98 levels and current running annual average concentrations for atrazine in finished drinking water are well below the MCL. Based on these reductions, the TCEQ and TSSWCB have recommended the removal of Aquilla Reservoir from the 2004 Texas 303(d) list for atrazine.

Project Summary

Task 1: Project Coordination

Subtask 1.1: Hill County Blackland (HCB) SWCD will hire a technician to collect water and soil samples, organize field demonstrations, and to assist with studies as requested by stakeholders.

The Hill County – Blackland Soil and Water Conservation District (HC-BL SWCD) hired Jennifer Rolison to serve as technician for the project (Figure 1). Jennifer's responsibilities included day-to-day management of the water and sediment sampling program, maintenance of the automatic sampling units, preparing sampler updates for Texas Cooperative Extension (TCE) staff, and assist with cost-share contracts associated with best management practices (BMPs) approved and implemented by USDA-Natural Resources Conservation Service (NRCS) and Texas State Soil and Water Conservation TSSWCB) staff. Reports and other emails provided by Jennifer to TCE staff are on file in the Department of Soil and Crop Sciences (SCS), Texas A&M University (TAMU).

Figure 1: Jennifer Rolison is preparing to collect a monthly grab Sample from the Aquilla 02 Site.

Subtask 1.2: TCE will train the technician on proper sample collection methods and immunoassay analysis technique.

TCE served to train Jennifer in collecting, preparing, and submitting all samples to the Texas Agricultural Experiment Station (TAES) Pesticide Fate Research Laboratory (PFRL). Sampling techniques demonstrated to Jennifer followed the QAPP submitted for this project. Chain of custody (COCs) forms were also used in the transport of all collected samples. Copies of the COCs are on file in the PFRL, SCS, TAMU. Dr. Monty C. Dozier, TCE specialist – water resources, directed the sampling program. Dr. Scott A. Senseman, TAES scientist, served as laboratory director of the project.

Samples submitted to the PFRL were handled and analyzed under the direction of PFRL manager, Dr. Kathy Carson.

Dozier also conducted a training session with Jennifer on analyzing water samples using immunoassay analysis techniques. However, based on the efficiency and accuracy of analyzing water samples using gas chromatography – mass spectrometry techniques, immunoassay analysis was not used during this project.

Subtask 1.3: TAMU Pesticide Fate Research Lab (PFRL) will prepare electronic quarterly and final reports. All progress reports will also be provided to stakeholders committee, project cooperators, and participants, as well as, the HC-BL SWCD directors.

TCE and TAES staff prepared and submitted quarterly reports to the TSSWCB. Dozier also provided updates of project to board meetings of the HC-BL SWCD and the Texas Watershed Protection Committee (TWPC). Dozier also met routinely with staff of the Hill County NRCS and staff from TSSWCB to provide project updates, review progress of the project, and make program delivery adjustments when necessary.

Task 2: Water Quality and Sediment Sampling to Monitor Effects of TMDL Implementation.

Subtask 2.1: TAMU PFRL will prepare the QAPP for the project.

Kathy Carson prepared the QAPP for this project. QAPP was approved by the US-EPA and TSSWCB. Copies were filed with each sponsoring agency and with the TAES-PFRL. An electronic version of the QAPP (minus the hardcopy appendix items) is attached to this report. A hard copy of the QAPP complete with appendices is on file in the SCS, TAMU.

Subtask 2.2: Technician will install 4 ISCO automated samplers within the watershed to monitor, atrazine, alachlor, and metolachlor at project-permanent locations.

Four Isco water sampling units were installed at the following sites (Figures 2 & 3): AQ 01 on lower Aquilla Creek near the intersection of Texas Highway 22 and FM 3050: AQ 02 on Hackberry Creek near the intersection of Texas Highway 171 and Hill County Road (HCR) 4223; AQ 05 on Jack's Branch near the intersection of Highway 22 and HCR 1340, and AQ 06 on Upper Aquilla Creek near the intersection of FM 309 and HCR 1367.

Figure 2: Location of the Automatic Sampler sites in the Aquilla Reservoir watershed. 01) AQ 01, 02) AQ 02, 05) AQ 05, 06) AQ 06, and AR) Aquilla Reservoir.

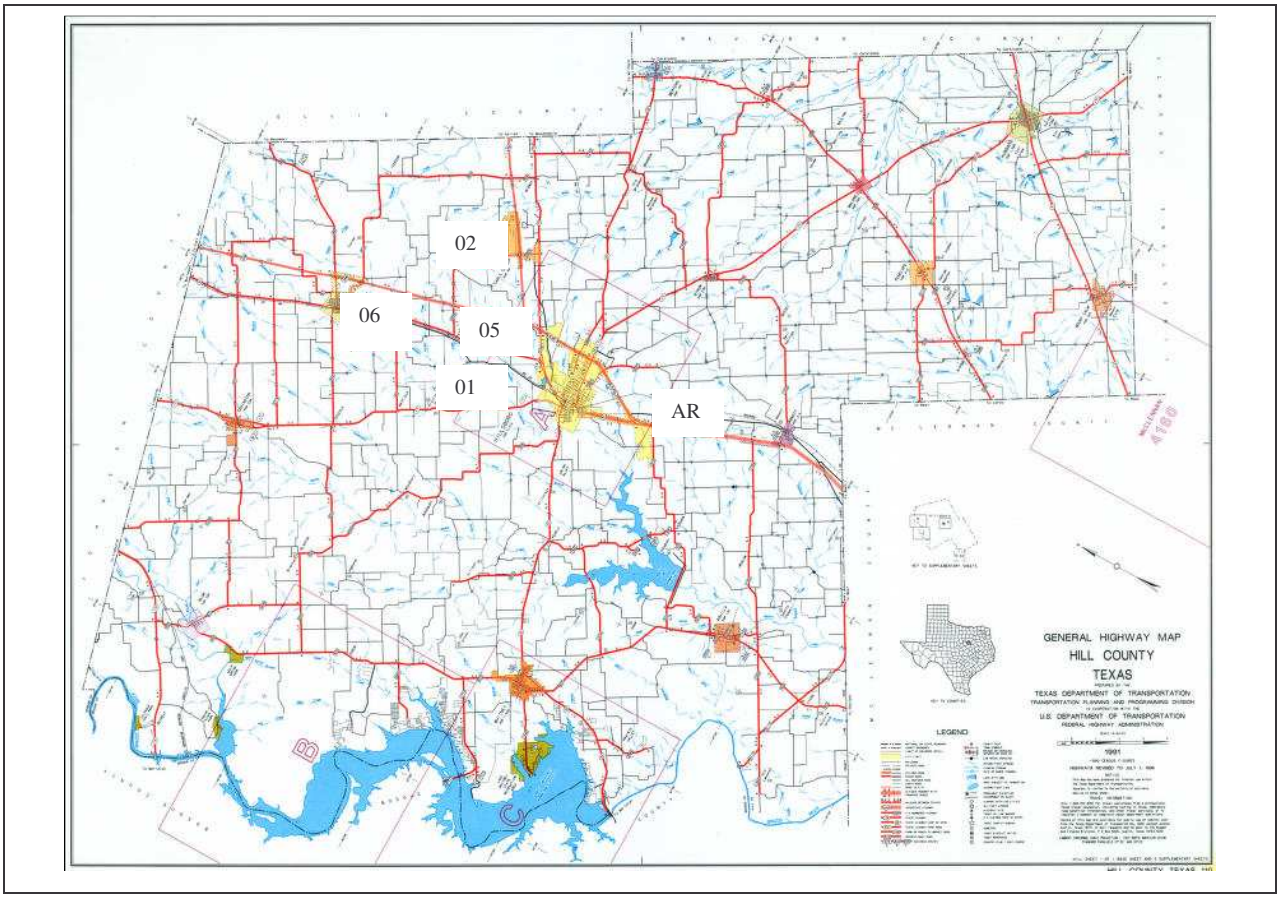

Figure 3: Scott Senseman and Russell Parks, ISCO Technical Representative, are shown installing one of the sampling units at the AQ 02 site on Hackberry Creek.

Subtask 2.3: Technician will install 3 Global Water automated samplers within the watershed to monitor atrazine, alachlor, and metolachlor at project-revolving locations. Deadline for subtask is the end of the project.

Based on a meeting with Monty and Jay Bragg, TSSWCB, on June 6, 2003 this portion of the workplan was changed. It was agreed that data retrieved from the two TDA automatic samplers be used to evaluate the effectiveness of grade stabilization structures (Figures 4 and 5) located near the TDA-UP site in reducing off-target losses of atrazine in surface runoff. A series of passive water sampling units at two separate locations will be used to evaluate off-target losses of atrazine from a grass waterway/sediment settling basin system (near AQ 02 site) and a grass filterstrip (near TDA-DOWN site) .

Edge-of-field automatic samplers were set up at a sediment retention structure (Figure 7) on 30 and 31 of July, 2003 by Jennifer Rolison, HC-BL SWCD, and Russell Parks, ISCO representative. Samplers designated as TDA-UP and TDA-Down and were placed to collect surface runoff from a grade stabilization structure study area (Figures 4 & 5). TDA-UP (Figure 6) is located on a creek just below the outflow of the grade stabilization structure. TDA-DOWN was located down stream of TDA-UP and across FM from the TDA-UP site. It should be noted that the placement of TDA-DOWN was on a different stream segment from TDA-UP.

In addition, during the January – March 2004 quarter, passive runoff samplers (Figure 7) were placed at the field adjacent to AQ 02 to determine effectiveness of grass waterway and sediment collection area in reducing atrazine losses in surface runoff. These samplers are designated as AQ 02 edge of field (end of corn field turnrow), AQ Up (end of waterway above sediment discharge pipe), and AQ Down (below sediment discharge pipe). Passive samplers were also installed in a field near the TDA samplers. A passive sampler was placed at the edge of the corn field and before a grass filterstrip (TDA – prefilter) and one below the grass filterstrip (TDA-post filter).

Figure 4: Grade stabilization structure designed to reduce sediment losses and Herbicide concentrations in surface runoff.

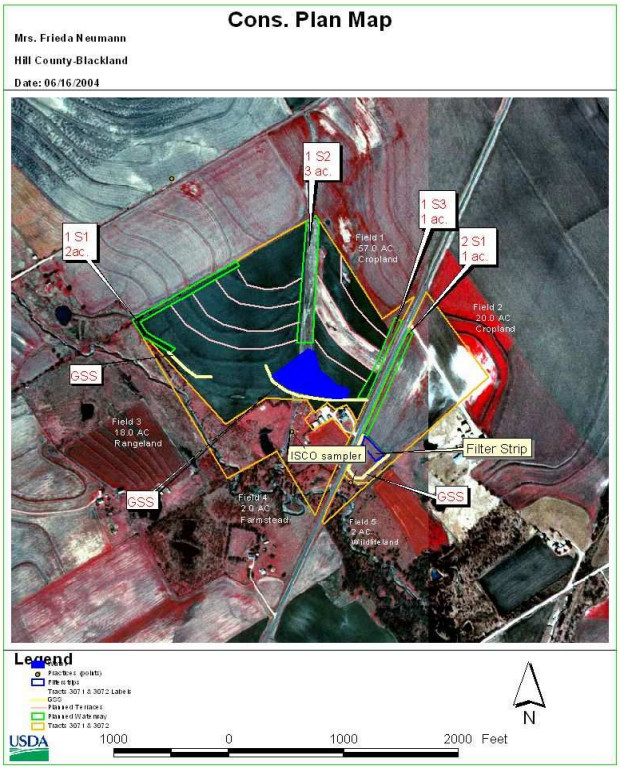

Figure 5: Map of location of TDA-Up and TDA-Down automatic sampling units to evaluate effectiveness of sediment retention structures in reducing herbicide concentrations in surface runoff.

Figure 6: Monty Dozier and Mason Miller, Texas Commission of Environmental Quality, recover samples collected during a runoff event by the TDA-UP automatic sampler.

Figure 7: Jennifer is retrieving a runoff sample collected by a passive sampler.

Subtask 2.4: Technician will collect grab samples from edge of field and tributaries to determine effectiveness of various management techniques (Figure 8) at reducing atrazine runoff and to monitor nutrients and dissolved oxygen.

In order to sample the tributaries for edge-of-field effects of atrazine and nutrients on the water quality of Aquilla Reservoir, grab samples were collected from AQ 01, AQ 02, AQ 05, and AQ 06 on a monthly or semi-monthly basis. No samples were collected during periods when no water was present.

Figure 8: Picture of grass filterstrips on each side of Hackberry Creek.

Dissolved oxygen readings (in mg/L or ppm) were taken from the same sites in March 2003 and August 2004. The results are recorded in Table 1.

DATE	SAMPLE SITE	Temp. (C^o)	DO READING (mg/L)	% Saturation
March 2, 2003	AQ 01	13.8	6.22	60
	AQ02	13.4	7.03	67
	AQ 05	13.7	6.75	65
	AQ 06	14.0	6.53	64
August 30, 2004	AQ 01	23.8	3.18	36
	AQ 02	26.8	1.36	25
	AQ 05	23.7	3.01	33
	AQ 06	24.6	1.37	14

Table 1: Dissolved oxygen readings from the Aquilla Reservoir watershed.

The August 2004 readings were taken during a hot period with rain absent for over 10 days under lower flow conditions. These factors may have contributed to the low DO readings.

Sediment was also collected from these sites and samples analyzed for nutrient content by the TCE Soil, Water, and Forage Testing Laboratory at Texas A&M University, College Station, TX. Results from this effort are outlined in Table 2.

DATE	SAMPLING SITE	NITROGEN (N) mg/Kg	PHOSPHORUS (P) mg/Kg	POTASSIUM (K) mg/Kg
7/14/03	AQ 01	7	128	361
	AQ 02	9	46	323
	AQ 05	11	20	95
	AQ 06	10	72	330
1/29/04	AQ 01	7	16	215
	AQ 02	3	9	187
	AQ 05	20	14	237
	AQ 06	3	14	150
1/29/04	AQ 01	18	29	154
	AQ 02	29	39	354
	AQ 05	18	31	207
	AQ 06	6	75	341

Table 2: N. P, and K results from samples collected in the Aquilla Reservoir watershed. Note: N ratings (mg/Kg) for corn (100 to 149 bu/A): very low, 0 – 15; low, 16 – 25; medium, 26 -50; high, 51 – 75; and very high, > 75. N ratings (mg/Kg) for coastal Bermuda (1 cutting plus grazing): very low, 0 – 10; low, 11 – 15; medium, 16 -25; high, 26 – 45; and very high, > 45.
Phosphorus ratings (mg/Kg) for all crops: very low, 0 – 15; low, 15 – 30; medium, 30 - 50; high, 50 – 80; and very high, > 80.
Potassium ratings (mg/Kg) for all crops: very low, 0 - 69; low, 70 - 119; medium, 120 - 174; high, 175 - 300; and very high, > 300.

For nitrogen, most samples fell in the very to low ranges indicating no concerns with nitrogen build up in sediment at any of the sampling stations. Phosphorus and potassium did not follow that same trend. P concentrations fell mainly in the medium to high range with one reading (7/14/03, AQ 01) reaching into the very high range. For K, most reading fell in the high to very high range.

Subtask 2.5: Edge of field samples will be analyzed for atrazine content using an Immunoassay Kit.

Grab samples were collected on a monthly or semi-monthly basis during the project from each of the four automatic sampling sites to monitor atrazine concentrations in the watershed. In order to insure more accurate results, all samples were analyzed using GS-MS techniques rather than an Immunoassay Kit.

Decreases in atrazine concentrations over the life of the project in grab samples are illustrated in Figure 9.

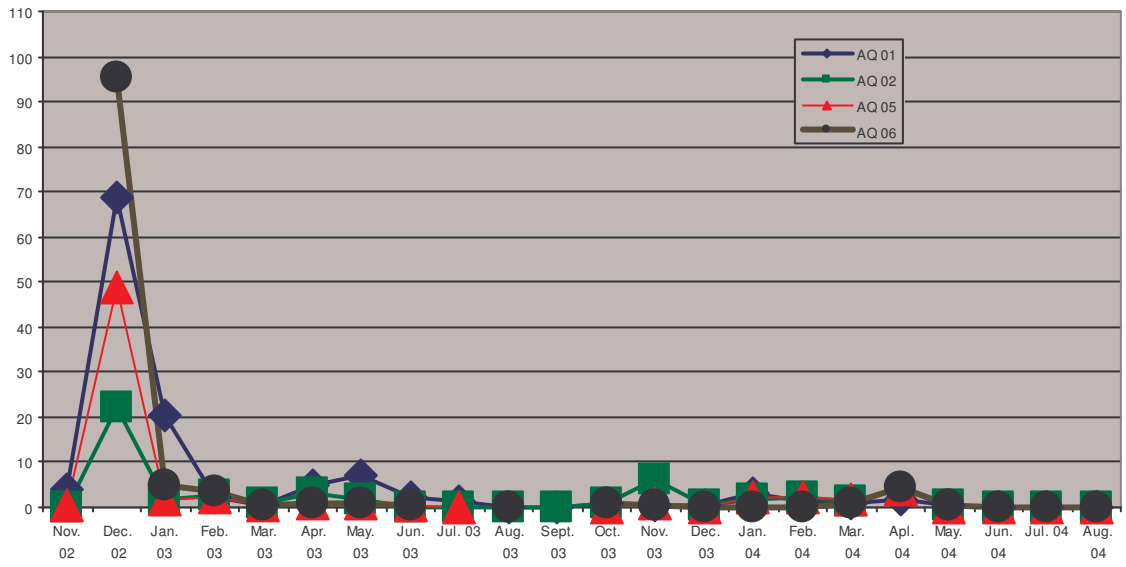

Figure 9: Atrazine concentrations from grab samples collected at the four Isco automatic sampling sites.

During the project, additional sampling sites were added to the grab sampling program at the request of the Hill County USDA-NRCS and HC-BL SWCD staff. These sites were Site AQ RC (November 1, 2002) and Site AQ WB and AQ 1330 B (March 27, 2003). AQ RC is located on the bridge over Rocky Creek on Hill County Road 2427 near Hill County Road 2424. AQ WB is located on the bridge over Hackberry Creek on FM 309 just south and east of the community of Woodbury. AQ 1330B is located on the bridge over Hackberry Creek on Hill County Road 1330.

The results from this effort are illustrated in Figure 10.

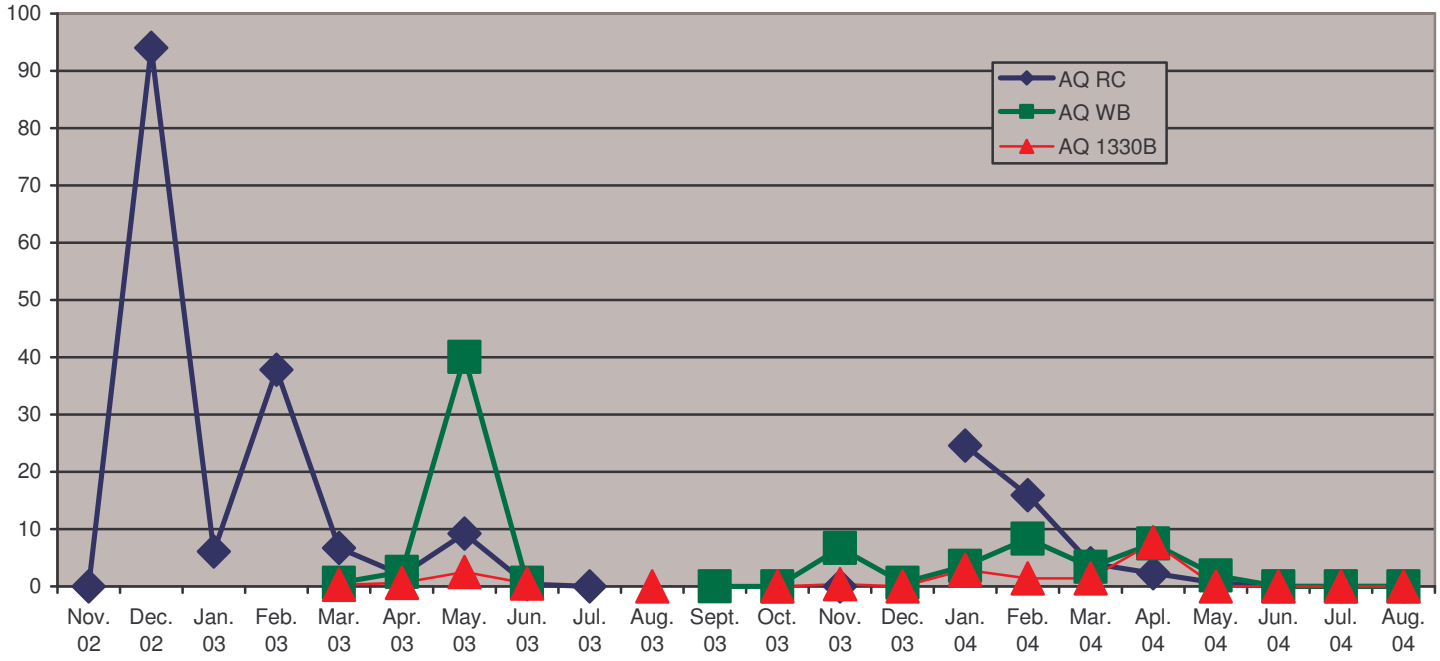

Figure 10: Atrazine concentrations from added grab sampling sites in the Aquilla Reservoir watershed.

Annual averages were calculated for the atrazine concentrations collected from each of the grab sampling sites. Table 3 depicts the changes in these concentrations:

Year	Site	Annual Atrazine Conc. (*u*g/L)
2001	AQ 01	10.82
2002	AQ 01	12.42
2003	AQ 01	3.35
2004	AQ 01	.98
2001	AQ 02	6.81
2002	AQ 02	9.93
2003	AQ 02	1.44
2004	AQ 02	1.26
2001	AQ 05	3.34
2002	AQ 05	11.22
2003	AQ 05	0.71
2004	AQ 05	1.23
2002	AQ 06	95.3
2003	AQ 06	1.32
2004	AQ 06	0.74
2002	AQ RC	94.0
2003	AQ RC	7.77
2004	AQ RC	5.92
2003	AQ WB	6.37
2004	AQ WB	3.07
2003	AQ 1330B	0.48
2004	AQ 1330B	1.67

Table 3: Annual atrazine concentrations from all grab sampling sites in the Aquilla Reservoir watershed.

For AQ 01; annual atrazine concentrations collected in 2003 decreased by 75% and by over 90% (2004) when compared to 2002 annual averages.

AQ 02 annual atrazine concentrations collected in 2003 decreased by over 85% and by 87% for 2004 compared to 2002 annual averages.

AQ 05 annual atrazine concentrations collected in 2003 decreased by over 85% and by 87% for 2004 compared to 2002 annual averages.

AQ 06 annual atrazine concentrations collected in 2003 (1.32 *u*g/L) and 2004 (0.74 *u*g/L) were lower than the only sample (95.3 *u*g/L) collected in 2002 (December 03).

AQ RC annual atrazine concentrations collected in 2003 (7.77 *u*g/L) and 2004 (5.92 *u*g/L) were lower than the average of the two samples (47 *u*g/L) collected in 2002 (November & December 03).

Sampling at the AQ WB and AQ 1330B sites did not begin until March 27, 2003 so no comparisons can be made between atrazine concentrations at or before the beginning of BMP placement in the watershed and those at the end of the project.

Review of this data would indicate the BMPs put into place through the HC-BL SWCD and the USDA NRCS have begun to be effective in reducing off-target losses of atrazine in surface runoff. Sampling of the watershed began at the beginning of the placement of BMPs and continued through the life of the project. As producers began to adopt and install BMPs in the watershed, reductions in atrazine concentrations were observed. This would indicate that producer buy-in regarding the adoption and use of the prescribed BMPs recommended by HC-BL SWCD and the Hillsboro office of USDA-NRCS have been effective in reducing atrazine concentrations in the watershed.

Table 4 reflects average atrazine concentrations from runoff events collected by the automatic ISCO samplers designated as TDA-UP and TDA-Down located near the grade stabilization structure on the Neumann farm (TDA-UP).

	TDA-UP		**TDA-DOWN**	
DATE	**Atrazine (*u*g/L)**	**Metolachlor (*u*g/L)**	**Atrazine (*u*g/L)**	**Metolachlor (*u*g/L)**
Aug. 29, 2003			0.5	
Nov. 25, 2003			0.30	0.25
Jan. 22, 2004			1.36	
March 2, 2004			5.25	
March 15, 2004			0.39	
April 11, 2004			13.37	21.05
April 30, 2004	26.75	24.07	20.73	68.39
May 11, 2004	0.19	25.80	0.00	41.86
June 11, 2004	1.01	4.65	0.53	0.81
June 30, 2004			0.21	2.08

Table 4: Herbicide concentrations from samples collected by the TDA-UP and TDA-DOWN automatic samplers. It should be noted that the data gaps on this table are a result of no runoff samples collected for that particular date.

Results from this portion of the project did not provide as much useful information as originally hoped. This is due to the original placement of both sampling units below the grade stabilization structure and on separate stream segments and the problems of unit failure experienced with the TDA-UP unit.

DATE	AQ 02 EOF Atrazine (*u*g/L)	AQ 02 UP Atrazine (*u*g/L)	AQ 02 DOWN Atrazine (*u*g/L)
Jan. 27, 2004	4.4	1.0	0.3
Feb. 13, 2004	0.6	0.7	1.0
March 2, 2004	0.5	0.8	1.1
March 9, 2004	0.0	0.0	0.9
April 9, 2004	7.5	0.6	1.0
May 27, 2004	1.2	0.5	2.8
June 11, 2004	0.5	0.4	0.5
June 30, 2004	0.0	0.0	0.0

Table 5: Atrazine concentrations from the BMP demonstration site located near AQ 02.

On January 27th and April 9th, atrazine concentrations were reduced by 78% (Jan. 27, AQ 02 UP) and 93% (Jan. 27, AQ 02 DOWN) and 92% (April 9, AQ 02 UP) and 87% (April 9, AQ 02 DOWN) compared to the edge of field (AQ 02 EOF) samples. On May 27, the AQ 02 UP sample concentration was 58% lower than the AQ 02EOF sample. However, AQ 02 DOWN was more than two times greater than the EOF sample. One explanation for this result is the close proximity of the AQ 02 DOWN passive sampler to the edge of Hackberry Creek. This reduction in atrazine concentrations between AQ 02 EOF samples and the AQ 02 Up samples demonstrates that the use of a grassed waterway at the edge of a field can be an excellent BMP in reducing off-target losses of atrazine in surface runoff. Review of the differences in atrazine concentrations between AQ 02 UP and AQ 02 Down are inconclusive in the effectiveness of the addition of the sediment control structure to the grassed waterway BMP system. Note: other samples were collected but these are the only dates where samples were collected in all three catchments.

Date	Pre-Filter		Post-Filter	
	Atrazine (*u*g/L)	Metolachlor (*u*g/L)	Atrazine (*u*g/L)	Metolachlor (*u*g/L)
March 9, 2004	0.0	0.0	0.8	
May 27, 2004	0.0	34.4	0.0	6.6
June 30, 2004	0.3	4.3	0.0	1.2
July 14, 2004	0.4	5.4	0.4	2.2
Aug. 30, 2004	0.0	2.1	0.0	0.0

Table 6: Atrazine and metolachlor concentrations from catchment devices at the BMP filterstrip site near TDA-DOWN.

The results from this site illustrated the effectiveness of a grass filterstrip in reducing off-target losses of atrazine and metolachlor in surface runoff. On May 27, metolachlor concentrations were reduced 80% (post-filter) compared to samples collected on the edge of the corn field (Pre-filter). Samples collected on June 30, July 14, and Aug. 30 continued to yield similar results (reductions of 60 to over 90%).

Subtask 2.6: Automated sampler-collected samples will be analyzed for atrazine, alachlor, and metolachlor using gas chromatograph method.

A total of 22 runoff events were collected by the four automatic Isco samplers located in the Aquilla watershed. Site AQ 01 captured 16 runoff events during the project and AQ 02 collected 12 events. Site AQ 06 collected runoff from 10 events. AQ 05 only collected one runoff event. Several problems were experienced with the AQ 05 sampling unit. The unit was vandalized once in which the solar panel was torn from the unit and stolen. After these repairs, the unit's intake tube was chewed in several places by a wild animal. Results from all the automatic sampling events are in Table 7.

Date	AQ 01			AQ 02			AQ 05			AQ 06		
	Atrz	Met	Ala	Atrz	Met	Ala	Atrz	Met	Ala	Atrz	Met	Ala
12/12/02	72.17	ND	ND									
12/19/02	63.01	ND	ND									
1/7/03	58.84	ND	ND	8.19	ND	ND	15.33			28.33	ND	ND
2/20/03	3.20	ND	ND									
2/27/03	1.90	ND	ND	10.30	ND	ND						
3/12/03	3.45	ND	ND	8.87	ND	ND						
3/27/03	0.70	ND	ND									
9/5/03										ND	ND	ND
9/15/03										ND	ND	ND
10/10/03	1.31	ND	ND	1.69	Trace	ND				ND	ND	ND
11/3/03				0.90	ND	ND						
1/22/04				10.74	ND	ND						
1/23/04	3.91	ND	ND							ND	ND	ND
2/13/04	3.75	ND	ND	4.18	ND	ND						
3/2/04	1.71	ND	ND	3.32	ND	ND				ND	ND	ND
3/15/04	1.45	ND	ND	2.74	ND	ND				ND	ND	ND
4/14/04	ND	ND	ND									
4/28/04				11.17	7.35	16.12				10.79	7.38	ND
5/11/04				3.72	2.87	1.50				2.72	2.47	0.41
5/27/04	0.48	0.34	ND									
6/11/04	0.25	ND	ND	1.05	0.36	ND				ND	ND	ND
6/30/04	ND	ND	ND	0.26	ND	ND						

Table 7: Atrazine (Atrz), metolachlor (Met), and Alachlor (Ala) herbicide concentrations (*u*g/L) for the AQ 01, AQ 02, AQ 05, and AQ 06 sampling sites. Simiazine was no listed in the table because it was never detected in concentrations above the detection limit. ND = sample concentrations were below the detection limit. Trace would indicate sample concentration was between the detection limit and the quantitation limit and a blank entry would indicate no water sample collected and analyzed for that site during the event. Detection and quantitation limits for each of the parameters were as follows:

Parameter	Detection Limit (*u*g/L)	Quantitation Limit (*u*g/L)
Alachlor	0.281	0.3
Metolachlor	0.214	0.3
Simazine	0.384	0.4

Atrazine	0.3	0.3

Atrazine concentrations for AQ 01 decreased from the three sampling events (12/12/02, 12/19/02, and 1/7/03) compared to the remaining sampling events recorded by this unit. Concentrations for atrazine did not change of samples collected at the AQ 02 site did not decrease as those from the AQ 01 site. Atrazine concentrations did decrease by over 50% from levels recorded on 1/7/03 compared to the concentrations recorded on April 28, 2004. These reductions would again indicate the placement and use of BMPs, by ag. producers under the direction of the staff from HC-BL SWCD and the Hillsboro office of the USDA-NRCS, have had an impact on reducing off-target losses of preemerge herbicides in the Aquilla watershed. The reductions in 2004 occurred during a wetter-than-normal rainfall year. The average annual rainfall for Hill County is 36 to 40 inches. In 2004, a total of 53.4 inches of rainfall was recorded for the county seat of Hillsboro. This is over 20 inches more than fell in 2003 (30.50 inches) and in 2002 (32.22 inches).

It should also be noted that simazine was not detected in any of the samples collected during this project. Metolachlor was detected in samples collected at the AQ 01 (only on 5/27/04), AQ 02 and the AQ 06 sites and alachlor only at the AQ 02 and AQ 06 (only on 5/11/04). Finally, atrazine was detected more often than either metolachlor or alachlor.

Subtask 2.7: Technician will collect sediment samples from designated streambeds and Aquilla reservoir in July and January.

Sediment samples were collected from each of the grab sampling sites on January 23, 2003, July 9, 2003, January 28, 2004, and July 14, 2004. Results from the analysis of these sediment samples for atrazine concentrations (*u*g/g) are outlined in Table 8.

Date	AQ 01	AQ 02	AQ 05	AQ 06	AQ RC	AQ WB	AQ 1330B	AQ Lake
1/23/03	ND	ND	ND	ND	ND	ND	ND	ND
7/9/03	ND	ND	ND	ND	ND	ND	ND	ND
1/27/04	ND	ND	0.88	ND	ND	ND	ND	ND
7/14/04	ND	ND	ND	ND	ND	ND	ND	ND

Table 8: Atrazine concentrations from sediment samples collected in the Aquilla Reservoir watershed.

Atrazine was only detected from one sample collected at the AQ 05 site on 1/27/04 and this detect was at a concentration below 1.0 *u*g/g (0.88 *u*g/g). This would indicate that very little atrazine is adsorbed to the sediment of Aquilla Reservoir. It can be assumed that given very little atrazine is adsorbed to sediment, little atrazine should desorb back into the water column of the watershed.

Final Conclusions

This monitoring effort along with reservoir sampling by the Texas Commission of Environmental Quality (TCEQ) validates the effectiveness of BMP efforts of the HC-BL SWCD and the Hillsboro NRCS and outreach efforts of TCE, HC-Bl SWCD, and the NRCS in reducing atrazine concentrations. 2003 and 2004 annual average atrazine concentrations from grab samples collected on a near monthly basis at several locations in the Aquilla Watershed showed a reduction in atrazine concentrations compared to 2001 and 2002 concentrations. This includes a year (2004) when almost 20 inches greater than the annual rainfall average of 36 to 40 inches of rain was recorded at Hillsboro, Texas. Through this team effort, ambient atrazine concentrations for Aquilla Reservoir have been reduced by over 60% compared to 1997 – 98 levels and current running annual average concentrations for atrazine in finished drinking water are well below the MCL. Based on these reductions, the TCEQ and TSSWCB have recommended the removal of Aquilla Reservoir from the 2004 Texas 303(d) list for atrazine.

These results clearly demonstrate the effectiveness of team work by all the agencies involved in developing and implementing a volunteer program designed to encourage and enable local ag. producers to install and use prescribed BMPs. By building upon the strengths each agency could offer, a synergist effect was realized. This synergist effect provided an excellent method to: 1) introduce ag. producers to the prescribed BMPs; 2) inform producers through educational programming efforts in order to equip producers with the required knowledge to make timely and wise decisions related to placement of BMPs on their individual operations; 3) provide cost-share funds to get BMPs on the ground; and 4) to monitor the effectiveness of BMP placement on reducing targeted herbicide concentrations in the Aquilla watershed and Aquilla Reservoir.