



NAVAL FACILITIES ENGINEERING SERVICE CENTER
Port Hueneme, California 93043-4370

TECHNICAL REPORT TR-2108-ENV

INFILTRATION CONTROL LANDFILL COVER DEMONSTRATION AT MARINE CORPS BASE, HAWAII



by

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June 1999

This research was funded by the Pollution Abatement Ashore Program managed by the Naval Facilities Engineering Command and sponsored by the Environmental Protection, Safety, and Occupational Health Division (N45) of the Chief of Naval Operations.

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-018	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 1999		3. REPORT TYPE AND DATES COVERED Final; Nov 1995 - Mar 1998
4. TITLE AND SUBTITLE INFILTRATION CONTROL LANDFILL COVER DEMONSTRATION AT MARINE CORPS BASE, HAWAII			5. FUNDING NUMBERS	
6. AUTHOR(S) Leslie Karr, Bryan Harre, and T.E. Hakonson, Ph.D., Environmental Evaluation Services, LLC				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Facilities Engineering Service Center 1100 23rd Ave. Port Hueneme, CA 93043-4370			8. PERFORMING ORGANIZATION REPORT NUMBER TR-2108-ENV	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESSES Chief of Naval Operations (N45) Crystal Plaza 2211 Jefferson Davis Highway Arlington, VA 22202			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
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14. SUBJECT TERMS Landfill caps, vegetative caps, infiltration control, evapotranspiration, precipitation			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	UL	

EXECUTIVE SUMMARY

To demonstrate the effectiveness of alternative landfill caps, the Naval Facilities Engineering Service Center (NFESC) teamed with the Los Alamos National Laboratory and Colorado State University to investigate the performance of a variety of vegetative caps. Demonstration caps were installed at Marine Corps Base Hawaii (MCBH) Kaneohe Bay in 1994. The study used an innovative, but simple concept to manipulate the fate of rain water falling on waste sites with moderate to high precipitation. The infiltration of water through the cap, or cover, was controlled by combining the powerful forces of evapotranspiration (ET) with engineered structures that limited infiltration of precipitation into the soil. This approach relied on diverting a sufficient amount of precipitation to control runoff so that any water that infiltrated into the soil was easily removed by ET. The study demonstrated two infiltration control (IC) designs, one involving a 20% enhancement of runoff and the other a 40% enhancement, with a conventional ET soil cover design to serve as a control (i.e., basis of comparison). This research was funded by the Pollution Abatement Ashore Program managed by the Naval Facilities Engineering Command and sponsored by the Environmental Protection, Safety and Occupational Health Division (N45) of the Chief of Naval Operations.

This report summarizes all the data collected during the MCBH landfill cover demonstration project between 11/95-3/98. Water balance data from the study were also compared against corresponding data for a Resource Conservation and Recovery Act (RCRA) clay cap obtained from the Environmental Protection Agency (EPA) Hydrologic Evaluation of Landfill Performance (HELP), version 3.0b, water balance model.

The results, based upon 28 months of field monitoring data, support the concept of using runoff enhancement to manage percolation of water through a landfill. For example, runoff increased and percolation decreased by a factor of 2-3 on the IC cover designs over that measured on the ET soil cap design. Differences in percolation were significant at $p=0.1$, due to high variability associated with the large range in precipitation events. Statistical tests also indicated that there was some advantage to using 40% runoff enhancement over 20% as the 40% IC design produced significantly more runoff ($p=0.008$) and less percolation ($p=0.056$).

Results also demonstrate that the hydrologic response of the MCBH cover designs was highly dependent on season and a related variable, the amount of precipitation falling during a particular month. Most of the runoff and percolation was generated during a few months in winter when most of the precipitation was measured. Furthermore, at least 75%-98% of the runoff and percolation was generated during the four months when precipitation exceeded 10 cm. Most months receiving less than 10 cm of precipitation contributed only minor amounts to the total runoff and percolation measured during the study.

Linear regression analysis indicated that runoff or percolation was not generated until a threshold monthly precipitation of 2-5 cm was exceeded. The relative amount of runoff or percolation from the field plots was significantly related to monthly precipitation. In contrast, HELP3.0b predicted runoff and percolation was either not related or weakly related to measured

precipitation. Better correspondence of predicted data to precipitation was obtained when synthetic precipitation was used in the regressions.

Based upon a comparison of the predicted hydrologic performance of a modified RCRA clay cover and the two IC designs, these results show that the 40% IC design was approximately equal to the RCRA design and the 20% IC design was approximately within a factor of 2 of the RCRA design in their ability to limit percolation. While the IC designs rely on limiting infiltration, the RCRA design relies on lateral diversion of soil moisture in a drainage layer to prevent percolation. Based on the HELP3.0b simulation of the RCRA design, about 15% of the precipitation was predicted as lateral flow from the drainage layer.

The performance characteristics of the IC designs, as observed in the MCBH study, offer a simple and inexpensive alternative for interim stabilization or final closure of landfills in humid regions where rainfall exceeds approximately 63.5 cm (25 inches) per year. The IC cover technology is simple in design, easy to install over an existing landfill cover, and easy to remove if other uses for the land emerge in the future.

ACKNOWLEDGMENTS

Special thanks is given to the Pollution Abatement Ashore Program managed by Naval Facilities Engineering Command and sponsored by the Environmental Protection, Safety and Occupational Health Division (N45) of the Chief of Naval Operations. The program contributed the funding necessary to support this research and significantly enhance the development and implementation of alternative landfill covers. Additionally, special thanks are given to the Marine Corps Base Hawaii at Kaneohe Bay. Their contributions and support were crucial to the success of the demonstration. Also, special thanks to Los Alamos National Laboratory who assisted in the initial design and construction of the demonstration plots. Lastly, special thanks are given to the team members from NFESC who assisted in the construction, data collection and analysis, and site maintenance.

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INTRODUCTION

This report presents final results on the Marine Corps Base Hawaii (MCBH) Kanehoe Bay study to evaluate infiltration control (IC) concepts for use in designing landfill covers. This research was funded by the Pollution Abatement Ashore Program managed by the Naval Facilities Engineering Command and sponsored by the Environmental Protection, Safety and Occupational Health Division (N45) of the Chief of Naval Operations. The first section presents the rationale, experimental methods, and technical approach used in conducting the study. The second section presents the results of the vegetation monitoring program including canopy and ground cover, aboveground biomass, and plant species composition. The third section presents the results of the water balance monitoring and compares the hydrologic performance of the various cover designs with the Hydrologic Evaluation of Landfill Performance (HELP), version 3.0b, predictions of RCRA clay cap performance. A final section synthesizes all of the data to develop conclusions and recommendations for implementation of IC cap designs for landfill closures.

BACKGROUND

Surface covers or caps are one of the most cost-effective methods to manage the human and ecological risks associated with landfills or buried wastes. The most common landfill covers currently being used are the Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) C or D caps. However, there are concerns that RCRA cap designs will not outlive the environmental risks created by the buried waste. These covers use multiple layers as a barrier to prevent precipitation from infiltrating the waste. The design consists of compacted clay which will, overtime, lead to the soil drying, shrinking, and cracking leaving the barrier ineffective. These cracks provide pathways for the infiltration of water into the waste. A plastic membrane is also used in the design which is susceptible to rupture under land settlement, penetration of roots, and burrowing animals.

In recognition of the need for new and improved capping technologies, the EPA is developing formal guidance to permit the use of a variety of alternative cap designs as long as they can be demonstrated to control contaminant migration (Skahn, 1997). Alternative caps do not use clay or plastic membranes and are significantly less expensive to build and maintain. For example, the complete RCRA cap design is estimated to cost from \$2-4M/ha (\$0.8-1.6M/ac), while alternatives, depending on the need for hydrologic control, can cost as little as \$0.1M/ha (\$0.04M/ac).

Research has led to the development of a variety of alternative landfill cap designs. Many of these alternative designs have been field tested to gain regulatory approval. Collaborators at Colorado State University, Los Alamos National Laboratory, the Naval Facilities Engineering Service Center (NFESC), the Department of Energy (DOE), and the Air Force, have investigated the performance of a variety of landfill capping alternatives since 1981 (Nyhan et al., 1990; Hakonson et al., 1992; Warren et al., 1996; and Paige et al., 1996). These investigations primarily used large field lysimeters to monitor the fate of precipitation falling on the soil surface. Field tests of some of that technology have been conducted in semi-arid environments of New Mexico and Utah, where rainfall is approximately 25.4 to 63.5 cm (10 to 25 inches) per year. Field tests

by DOE and the Air Force evaluated a variety of cover alternatives, some of which are 10^3 - 10^4 times less costly than the removal option for hazardous waste sites (Hakonson, 1992).

Although alternative caps have been demonstrated to be effective in semi-arid environments, regulatory agencies are still reluctant to approve alternative landfill designs based on a lack of evidence that the technology is effective at all sites. To provide evidence that alternative cap designs effectively limit infiltration at humid regions, where rainfall exceeds approximately 63.5 cm (25 inches) per year, NFESC teamed with the Los Alamos National Laboratory and Colorado State University to investigate the performance of a variety of vegetative caps at MCBH Kaneohe Bay.

The goal of this and past studies was to develop and test a variety of capping designs, of various complexities and costs, and provide the data or evidence required by regulators to approve the widespread use of alternative caps. This will provide the risk manager with cost-effective alternatives that match the need for hydrologic control at the site.

CONCEPTUAL APPROACH TO MCBH LANDFILL COVER DEMONSTRATION

Most capping technologies incorporate design features which control one or more of the processes governing the fate of precipitation falling on the landfill. The fate of meteoric water falling on the landfill is often referred to as the water balance of the site. A simplified representation of water balance describes surface runoff and one-dimensional movement of water in the soil profile to the plant rooting depth. For net rates and amounts, the water balance equation is:

$$\delta S/dt = (P - R - ET - L)/dt \quad (\text{Equation 1})$$

where δS is the change in soil moisture storage, P is the precipitation, R is the runoff, ET is the evapotranspiration, L is the percolation below the root zone, and t is the unit of time used in solving the equation. Units on the terms in the equations are either cm/unit area or cm of water.

The concept of water balance, relative to design of landfill covers, accounts for the strong interactions between the various terms of Equation 1. For example, a reduction or elimination of the runoff term (R) increases infiltration of water into the soil, resulting in increased soil moisture storage followed by an increase in ET and/or percolation. Likewise, a reduction of ET must be followed by increased percolation in order to maintain hydrologic mass balance.

The importance of vegetation cover, and particularly the composition and density of the cover, on contaminant transport from disturbed areas cannot be over-emphasized. First vegetation plays a key role in controlling erosion by wind and water (Hakonson and Lane, 1993). Vegetation roots and decaying plant material bind the soil together while aboveground foliage intercepts both wind and incoming raindrops, decreasing the energy delivered to the soil surface and, thus, decreasing the potential to initiate erosion. The type and density of the vegetation are important attributes that influence the ability of the cover to protect the soil against erosion.

Vegetation is also important in controlling contaminant transport from a waste site by exerting a major influence on site water balance. In semi-arid regions (i.e., < 63.5 cm annual precipitation), the vegetation cover may return nearly 100% of the annual precipitation back to the atmosphere via transpiration of soil moisture from plant surfaces. It is especially important that the vegetation cover consist of species that are actively transpiring during seasons when precipitation occurs, to reduce the potential for movement of soil moisture downward into the vadose zone. At MCBH Kaneohe Bay, the 7 month period between October through April receives 75% of the annual precipitation. Thus, an optimally vegetated site (usually a plant cover that would exist at the site under undisturbed conditions) is an effective means of controlling percolation of surface moisture and associated contaminants downward into the vadose zone.

The coupled nature of the processes comprising the water balance can be used in designing landfill caps that change terms in Equation 1 that contribute to contaminant migration (i.e., percolation) while enhancing other terms (i.e., ET) that do not. The concept of water balance and methods to manipulate its various components has served as the basis for several studies to design, test, and evaluate a variety of capping alternatives for radioactive and hazardous waste landfills (Nyhan et al., 1990; Hakonson et al., 1992; Hakonson et al., 1993; Lane 1984; Lane and Nyhan 1984). For example, past studies have emphasized the role of vegetation in removing soil moisture via evapotranspiration, the use of subsurface barriers to intercept and laterally divert percolating water, and surface management practices to control runoff and erosion.

Nearly all of the past work has been conducted in arid or semi-arid environments with annual precipitation of less than 63.5 cm per year (Nyhan et al., 1990; Hakonson et al., 1992; Hakonson et al., 1993; Lane, 1984; Lane and Nyhan, 1984). In more humid climates, and especially those which average more than 75 cm of precipitation per year, the amount of soil moisture that can be removed by vegetation is usually less than the annual precipitation. This leads to an excess of soil moisture that is available for subsurface percolation into the waste environment. The annual average precipitation at MCBH is 97.0 cm, an amount greater than can be removed from the soil by evapotranspiration alone.

Because the maximum amount of soil moisture that can be removed by evapotranspiration has an upper limit, a cover design is needed for humid sites that minimizes the possibility of excess soil moisture that would otherwise percolate into the waste. There are several possible ways to manage this soil moisture including the use of hydraulic or capillary barriers to laterally divert percolating water away from the waste environment or methods to limit infiltration of precipitation into the cover soil.

The study at MCBH focuses on the latter approach by enhancing surface runoff, thereby reducing the amount of soil water that must be partitioned between the ET and percolation terms in Equation 1. The theory behind these designs is to limit percolation of water through the cap by enhancing runoff (Figure 1) and then using the very powerful evaporative forces of vegetation to remove that moisture which does infiltrate into the soil. The approach relies on diverting enough of the annual precipitation to runoff, using water harvesting structures, so that infiltration into the soil can easily be removed by evapotranspiration.

The use of IC techniques for managing waste site water balance is potentially attractive because it can be applied to an existing landfill cover, where it is easily repairable, and involves a minimum of materials, equipment, and labor. Some of the pioneering work on IC techniques in landfill covers was conducted by Dr. R. K. Schulz, University of California, Berkeley, with U.S. Nuclear Regulatory Commission funding (Schulz et al., 1990). However, the technical basis for IC as a means of water management has its roots in ancient history. For example, Hebrew farmers, 8000 years ago in the Negev Desert, developed and used IC techniques to harvest water to support a flourishing agriculture (Evenari et al., 1961).

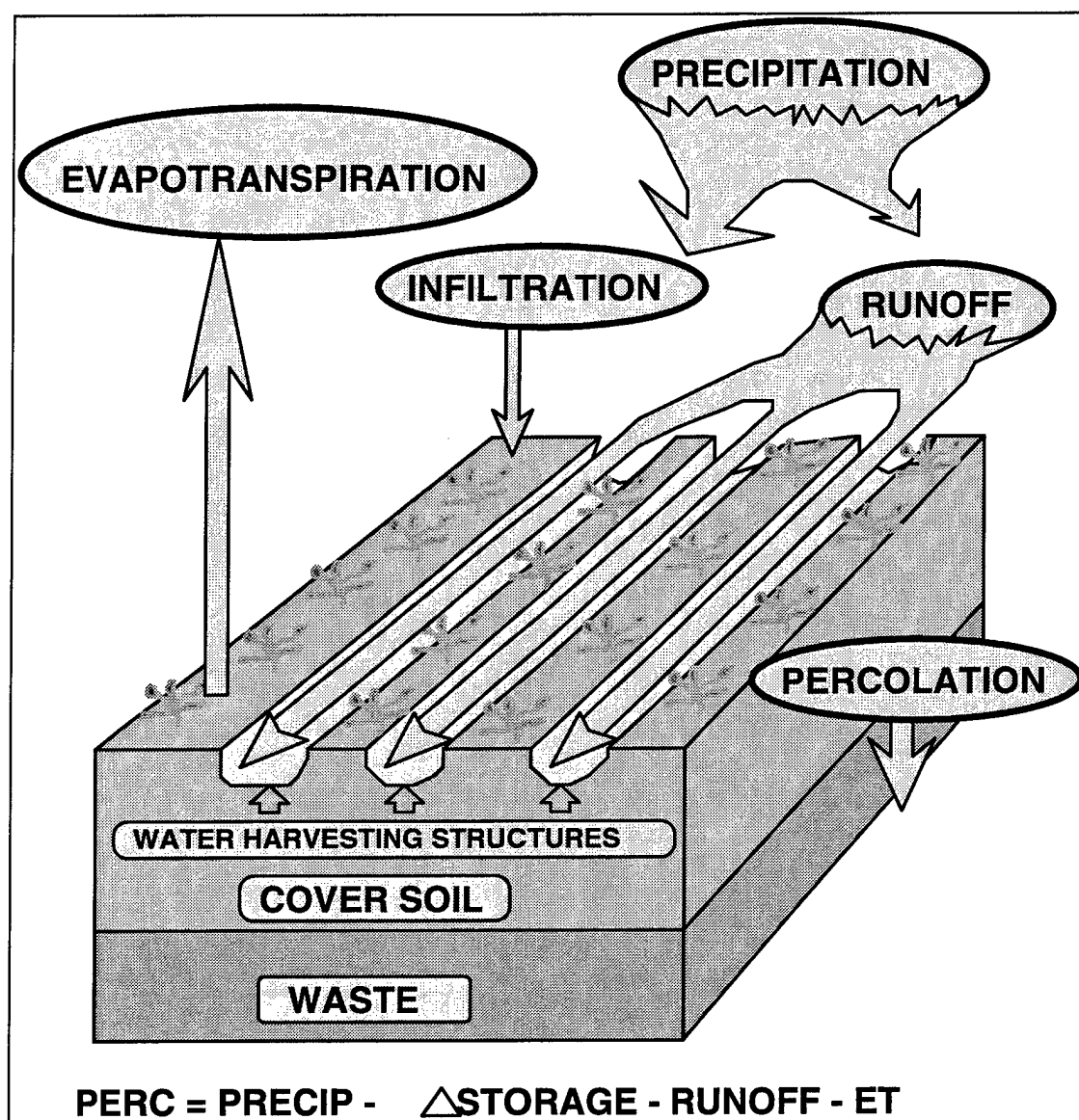


Figure 1. Conceptual infiltration control landfill cover design used at MCBH.

GOALS AND OBJECTIVES

The objectives of the MCBH study were to compare the hydrologic performance of two IC designs, one involving a 20% enhancement of runoff and the other a 40% enhancement, with a conventional ET soil cover design. The equivalency of the three designs to the EPA RCRA C design was evaluated by comparing the predicted performance of the IC designs with the RCRA clay cap design using the EPA's HELP3.0b model (EPA, 1994).

METHODS AND MATERIALS

Study Area: Marine Corps Base Hawaii is located on the eastern side of Oahu, adjacent to Kaneohe Bay (Figure 2). It receives an average of about 97.0 cm (38 inches) of annual precipitation, primarily during October-April (Table 1). Average monthly temperatures range from 23-27 °C and average 25 °C (77 °F) for the year. Leeward winds are very steady at the site and average about 17 km/hr (12 mph) with maximum gusts ranging from 56-155 km/hr (35-97 mph). Vegetation surrounding the study site consists of a mixture of shrubs and grasses primarily of the Acacia and Panicum families. Much of the surrounding area was highly disturbed at some point in the past due to the sanitary landfill operations at the site. The soils are derived from weathered Basalt and have a silt-clay content (i.e., < 75 µm particle diameter) of about 60%. Saturated hydraulic conductivity of the native soil averages about 5×10^{-7} cm/sec. Results of the geotechnical and hydraulic analysis of the soil that was used to construct the cover treatments are presented in Appendix A (Daniel B. Stephens and Associates, Inc., 1994).

Experimental Design: A detailed construction plan for installing the MCBH cap designs and the associated monitoring system is presented in Appendix B. The demonstration site is approximately 1/20 ha (1/8 ac), it was rough leveled and then excavated to remove the top 60 cm of soil. Six plots, 6 m wide x 9 m long (Hakonson, 1994), were then surveyed on this area. From bottom to top, the profile of each plot consisted of a 0.3 x 3 x 8 m underdrain, lined with a double layer of heavy duty plastic membrane filled with gravel, including a 15 cm diameter drain. A 60 cm layer of compacted soil was placed over the underdrain. The soil was allowed to penetrate into the gravel to degrade any capillary barrier effect that might have resulted from layering soil over the gravel. The surface of the plots were vegetated and, depending on treatment, rain gutters were placed in various densities along the slope to enhance runoff (Figure 3; also see Appendix B).

Initial calculations, based on an average MCBH precipitation of 97.0 cm, suggested that runoff enhancing structures installed on about 20% and 40% of the cover surface would, theoretically, be sufficient to reduce percolation through the cover to very low levels. Runoff enhancing structures were constructed from 12 cm wide metal rain gutter placed on the ground surface, parallel to the long axis, and slope, of the plots. The ET soil cover design was constructed without runoff collectors on the surface. A downslope trough was used to collect runoff and channel it via a 15 cm diameter pipe to a metering system. Soils used in constructing the cover profiles were compacted to 95% of optimum on placement. All plots had a surface slope of 5% along the long axis and were seeded with native grasses and shrubs as described below.

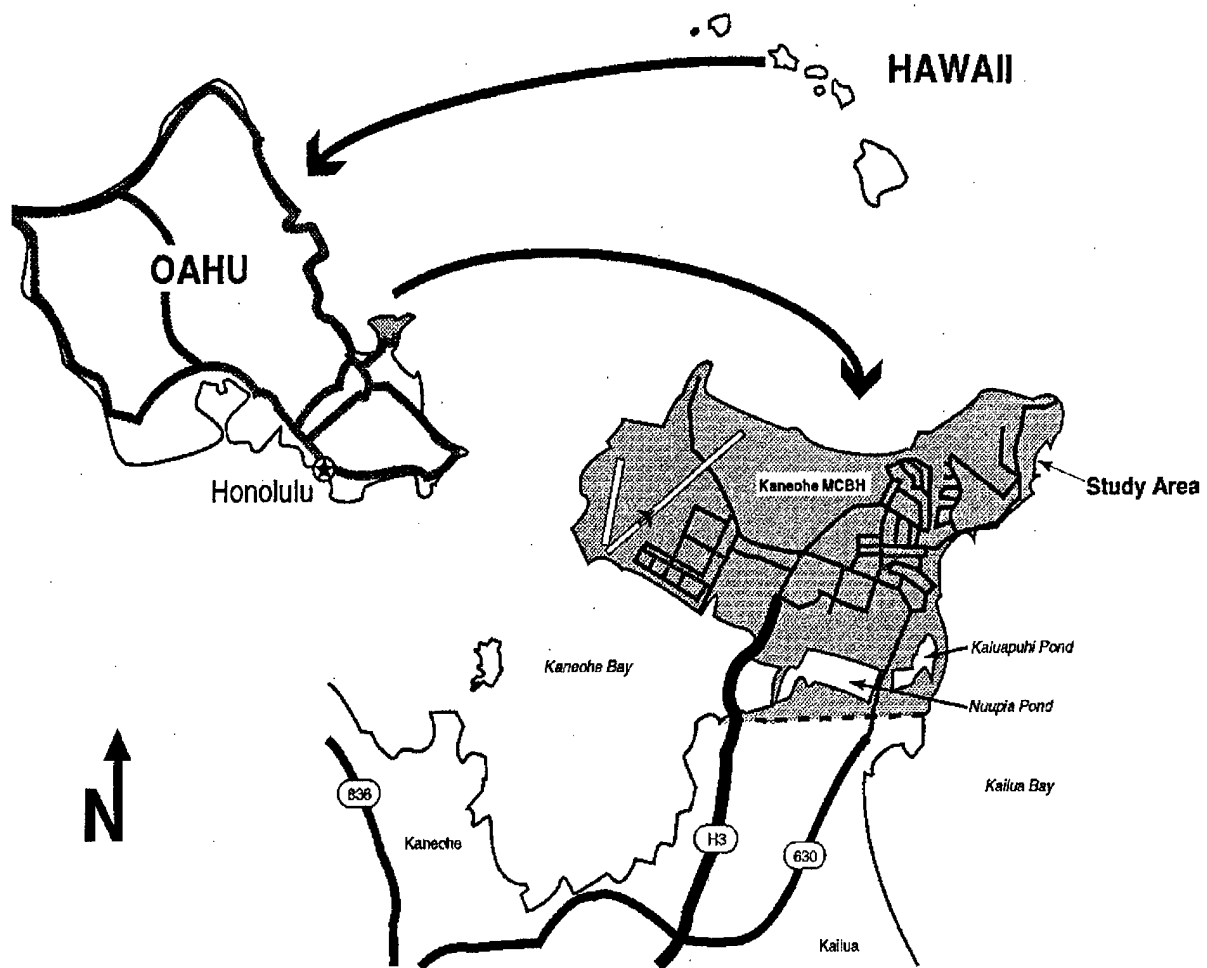


Figure 2. Location of landfill capping demonstration site at MCBH.

Table 1. Mean monthly rainfall at MCBH based on long term records.

MONTH	PRECIP (cm)	PRECIP (in.)	TEMP (°C)	TEMP (°F)	WS (MPH)
JAN	13.97	5.5	23.33	74	10
FEB	9.65	3.8	23.33	74	11
MAR	9.65	3.8	23.33	74	11
APR	9.14	3.6	23.88	75	11
MAY	5.84	2.3	24.44	76	10
JUNE	3.30	1.3	25.55	78	10
JULY	4.83	1.9	26.11	79	10
AUG	4.57	1.8	26.66	80	10
SEPT	4.83	1.9	26.66	80	9
OCT	7.62	3.0	26.11	79	9
NOV	11.68	4.6	25.0	77	10
DEC	11.43	4.5	23.88	75	11
ANNUAL	96.52	38.0	25.0	77	10

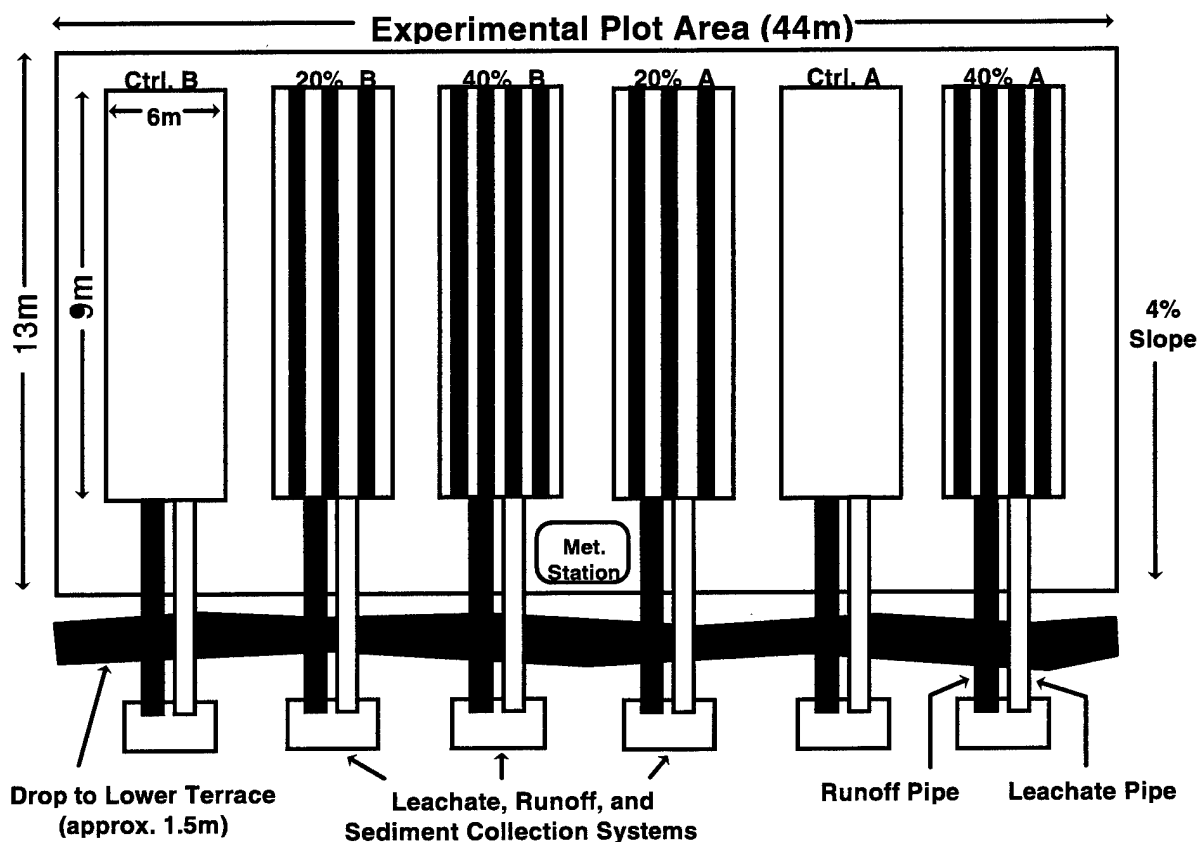


Figure 3. Plan view of MCBH infiltration control landfill cover designs.

Water Balance Monitoring System: Instrumentation was installed (Table 2, Figure 4). to permit direct measurement of runoff, percolation through the cover, soil moisture status, and precipitation. A variety of sensors were used including flow meters, pressure transducers, time domain reflectometry (TDR) probes, and tipping bucket flow gauges coupled to a Campbell Scientific data logger (see Appendix C for complete description of monitoring equipment and the data acquisition system. Stored data were downloaded by cellular phone link to NFESC in Port Hueneme CA.

Vegetation Cover and Monitoring: The goal of the seeding operation was to establish a cover consisting of grasses and shrubs that were typical of the surrounding plant communities. The scientific and common names, and seeding rates for the 6 species seeded into the plots are presented in Table 3. The seeds were obtained from local vendors.

Beginning the first week of June, seed mixture was hand broadcast onto the surface of each plot and then the surface was scarified to a depth of about 1 cm with a hand rake to cover most of the seeds with soil. Fertilizer was also broadcast onto the surface of the plot at a rate of 100 lbs N/ac (300 lbs of 34-0-0 ammonium nitrate) and 50 lbs P/ac (130 lbs of 0-45-0 triple super phosphate).

A lawn sprinkler system was used to irrigate the plots over a 4 week period. Because the June planting corresponded to the beginning of the dry season at MCBH, watering was conducted almost continuously over a 4 week period in order to keep the soil surface moist enough to germinate the seeds.

Canopy and ground cover was characterized on all of the plots using a modified point frame technique (Levy and Madden, 1933). The point frame was positioned at 10 equidistant locations (Pieper, 1973) perpendicular to the 9 m axis of each plot resulting in 61 measurements per point frame position and 610 measurements per plot. Canopy cover was determined by recording the type of vegetation first contacted by the point frame pin. The canopy cover categories included grass, shrub, forb, and standing dead. Ground cover was estimated by recording the first type of material contacted by the pin as it touched the ground surface. Identification of species present on the plots was made by Dr. Timothy Motley from University of Hawaii. Dr. Motley listed species present on the plots in 1996 and 1997. Photos and a species list developed by Dr. Motley were used to obtain quantitative estimates of species composition on the plots for several time periods during the study. Categories of ground cover included litter, bare soil, and gutter. The data form used to record the pin hits is presented in Appendix D.

Biomass estimates were made by dividing each plot into 3 sections, the upslope 3 m, a midslope 3 m, and a lower 3 m. A quadrant of 0.1 m² was randomly thrown into each section, resulting in 3 biomass estimates per plot. The quadrant was positioned on the ground surface and all the plant material within the boundary of a vertical projection of the quadrant, including plant material hanging into the quadrant, was clipped and bagged for drying and weighing. Biomass estimates were made on standing live plants, standing dead plants, and litter.

Table 2. Techniques for measuring water balance on MCBH infiltration control landfill cover demonstration plots.

Water Balance Component	Estimation Method	Measurement Frequency	Minimum Sensitivity
Precipitation	Tipping bucket at ground surface and 1 m height	Hourly	0.005l
Soil Moisture	4 TDR probes/plot; placed at 0-15 cm depths	Hourly	0.5% (vol/vol)
Runoff	Flow meters/pressure Transducers	Every 15 min.	0.01 cm+
Leachate	Flow meters/pressure transducers	Every 15 min.	0.02 cm
Evapotranspiration	Obtained by solving for ET, (equation 1 pg. 2)		
Sediment	Total collection	Every 3 month	0.5g

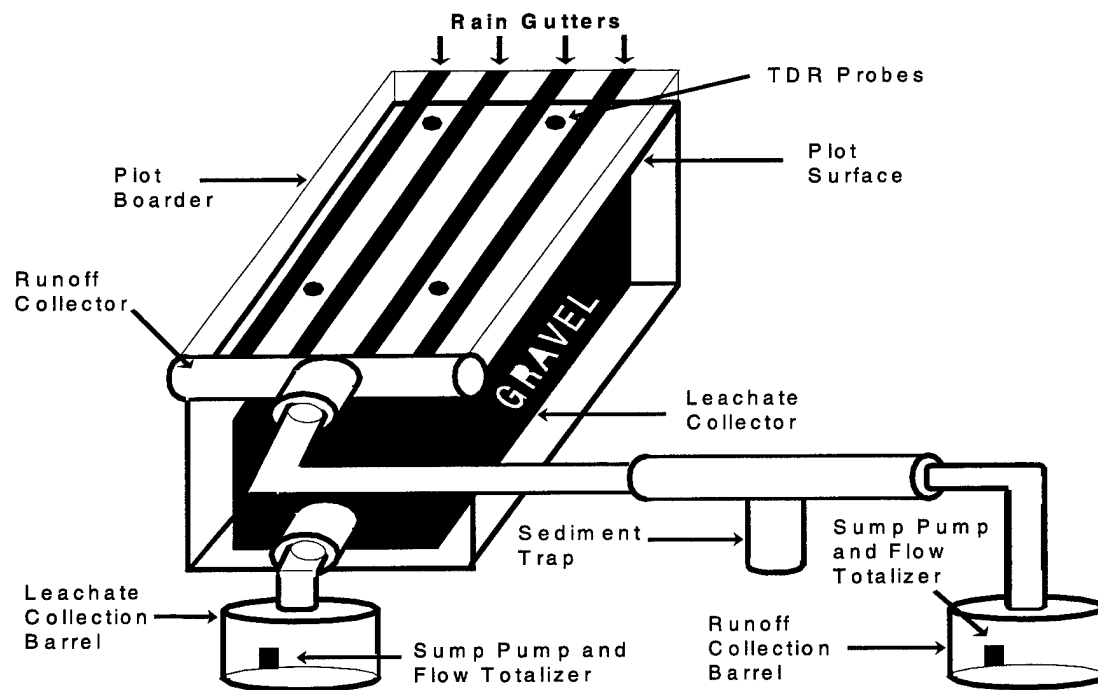


Figure 4. Schematic of data acquisition system used to monitor water balance at MCBH.

Table 3. Vegetation species and seeding rates used to revegetate the landfill cover plots at MCBH in June 1994.

Scientific name	Common Name	Seed Rate (lbs PLS/ac)
<i>Chloris radiata</i>	Stargrass	2
<i>Cenchrus ciliaris</i>	Buffelgrass	6
<i>Cynodon dactylon</i>	Common Bermudagrass	1
<i>Panicum coloratum</i>	Blue Panic	3
<i>Panicum maximum</i>	Guinea Grass	3
<i>Leucaena leucocephala</i>	Koa Haole (popinac)	2

Note: PLS - potential live seed

Material was classified as live if the plant was predominately green and extending above the ground surface. Some dead plants were partly lying on the ground surface and partly off the ground surface. Dead plant material that was predominately on the ground surface was classified as litter while that predominately off the ground surface was classified as standing dead. Plant material was segregated into either shrub, forb, grass, standing dead, or litter. Samples were air dried for several months and then weighed. Point frame data were analyzed with ANOVA using each transect (10/plot) as a replicate sample (Ostle, 1966).

HELP3.0b Modeling: The input data for simulating the RCRA clay cap with the HELP3.0b model is presented in Table 4. Briefly, the RCRA cap, from top to bottom, consisted of a 60 cm vegetated layer, a 30 cm drainage layer of sand, and a 30 cm layer of compacted clay with a hydraulic conductivity of 10^{-7} cm/sec. The model CLIGEN (Nicks and Lane, 1989) was used to synthetically generate the precipitation files for MCBH. Also, a flexible membrane liner was not included as a design component of the RCRA cap. The simulation was run for a 30 year period. Thus the modeling results presented in this report are 30 year average values.

RESULTS

Raw Data: All of the original data summaries on vegetation canopy and ground cover, species composition, and water balance monitoring are presented in Appendices E through O. Only summaries of that data are presented in the body of this report.

Vegetation Characteristics: All of the data related to vegetation species composition and vegetation canopy and ground cover are presented in Appendices E through H. Over the 28 month study period, a total of 21 species were identified on the plots in 1996 and 27 species in 1997 (Appendices E and F). Common grass species present on most of the plots in both years were *Cenchrus ciliaris* (L.) (Buffelgrass), *Chloris barbata* (L.) Sw. (Swollen fingergrass), *Panicum maximum* Jacq. (Guinea grass), and *Panicum repens* (L.) (Torpedo or quack grass). Common forbs occurring on most plots during both years were *Bidens pilosa* (L.) (Spanish needle), *Chamaecrista nictans* (L.) Moench (Partridge pea), *Crotalaria verrucosa* (L.) (blueflowered rattlespod), *Desmanthus virgatus* (L.) Willd. (Slender mimosa), *Indigofera spicata*

Table 4. HELP3.0b input data used in simulating the EPA RCRA clay cap for MCBH conditions. (Station latitude = 21.33 degrees).

Layer 1- Vertical Percolation Layer	
SCS Runoff Curve Number	80.50
Evaporative Zone Depth	24.0 Inches
Thickness	24.00 Inches
Porosity	0.4640 Vol/Vol
Field Capacity	0.3100 Vol/Vol
Wilting Point	0.1870 Vol/Vol
Initial Soil Water Content	0.2719 Vol/Vol
Effective Sat. Hyd. Cond.	6.4×10^{-5} cm/sec
Layer 2- Lateral Drainage Layer	
Thickness	12.00 Inches
Porosity	0.3970 Vol/Vol
Field Capacity	0.0320 Vol/Vol
Wilting Point	0.0130 Vol/Vol
Initial Soil Water Content	0.0328 Vol/Vol
Effective Sat. Hyd. Cond	0.3 cm/sec
Slope	4.00 Percent
Drainage Length	208.0 Feet
Layer 3- Barrier Soil Liner	
Thickness	12.00 Inches
Porosity	0.4270 Vol/Vol
Field Capacity	0.4180 Vol/Vol
Wilting Point	0.3670 Vol/Vol
Initial Soil Water Content	0.4270 Vol/Vol
Effective Sat. Hyd. Cond.	1×10^{-7} cm/sec
Evapotranspiration And Weather Data	
Maximum Leaf Area Index	5.00
Start Of Growing Season	(Julian Date 0)
End Of Growing Season	(Julian Date 365)
Average Annual Wind Speed	11.70 mph
Precipitation file for MCBH was generated using CLIGEN (Nicks and Lane, 1989)	

Forssk. (Creeping indigo), and *Indigofera suffruticosa* Mill. (Indigo). The most common shrubs on plots during both years were *Leucaena leucocephala* (Lam.) de Wit (Koa haole) and *Stachytarpheta jamaicensis* (L.) Vahl (Jamaica vervain) (Appendices E and F).

Most of the grass and one shrub species seeded into the plots at the beginning of the study (see Table 3 for species seeded into the plots) were present in the vegetation cover during the 2 year period (see Appendix E and F for species recorded on the plots). However all of the forbs and most of the shrubs present on the plots during both years were invaders from nearby areas.

The structural diversity of the vegetation canopy on all plots was dominated by grass species which comprised 25-60% of the total canopy cover (live plus dead; Figure 5) and 65-95% of the live vegetation cover (Figure 6). Live grass cover peaked during January and February and reached a minimum during June and July. At least 80% of the live grass cover was due to one species, *Panicum repens*.

Forbs, which were all invaders to the plots in that they were not in the original seed mixture, made up as much as 24% of the total cover (Figure 7) and about 15-33% of the live cover (Figure 6). Overall, however, forbs contributed less than 15% to the total live plant cover (Figure 6). Shrubs contributed least to plant cover on the plots. Shrub contributions to the total canopy cover were a maximum of about 8% (Figure 8) and, to live cover, a maximum of about 11%.

Seasonal changes in live vegetation cover were statistically significant and declined from highs in January-March to lows in June-August as shown by the data for live cover species in Figures 5, 7, and 8. These changes probably reflect the relationship of vegetation phenology to precipitation patterns at MCBH. The months of May-September are relatively dry (Table 1), a period when much of the vegetation is senescent. Conversely, standing dead vegetation peaked in the summer and was lowest during the winter months of October-April (Figure 6).

Standing dead vegetation (Figure 9) comprised about 10-60% of the total canopy cover and showed seasonal patterns that were the opposite of live vegetation. For example, peak standing dead material occurred in June and July while minimums occurred in January and February.

Surprisingly, the total amount of cover (live plus standing dead) on all three treatments was statistically similar ($p=0.08$) despite the presence of runoff collectors on 20% and 40% of the surface of the IC designs (Figure 10). Live canopy cover (Figure 11) on the soil and 20% IC designs were not significantly different ($p<0.05$) while the 40% IC designs averaged about 15% less live cover, which was significant ($p<0.05$). Ground cover changed markedly through the study reflecting the buildup of litter on the ground surface. These changes were characterized by decreasing bare soil (Figure 12) as litter cover increased from near zero in March to 90-100% in July (Figure 13), exclusive of the gutters on the ground surface. The amount of plot surfaces covered by gutters, as measured with the point frame, averaged 24% and 44% for the 20% and 40% IC designs (Figure 14).

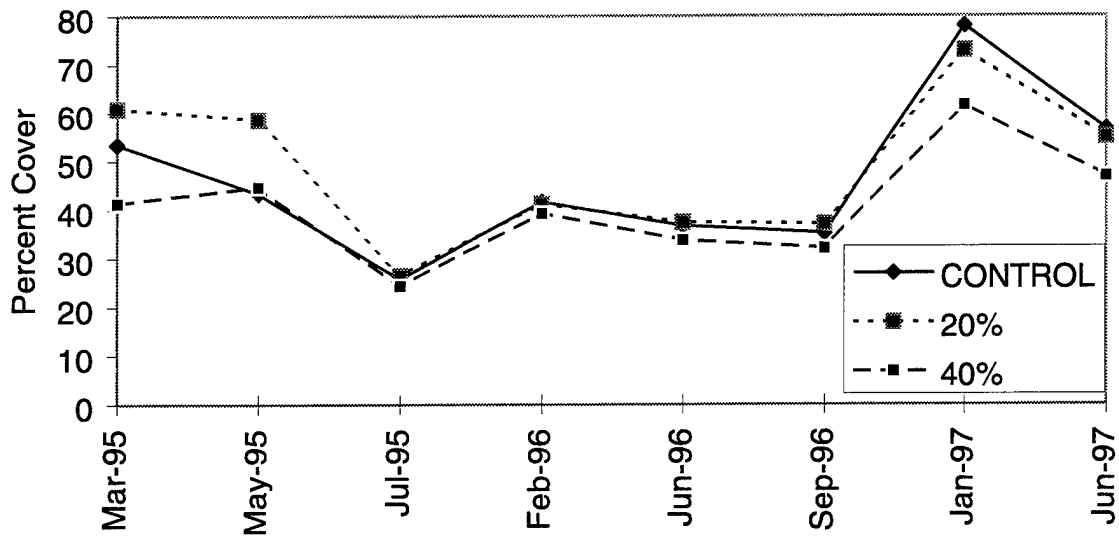


Figure 5. Contribution of grass cover to total canopy cover at MCBH.

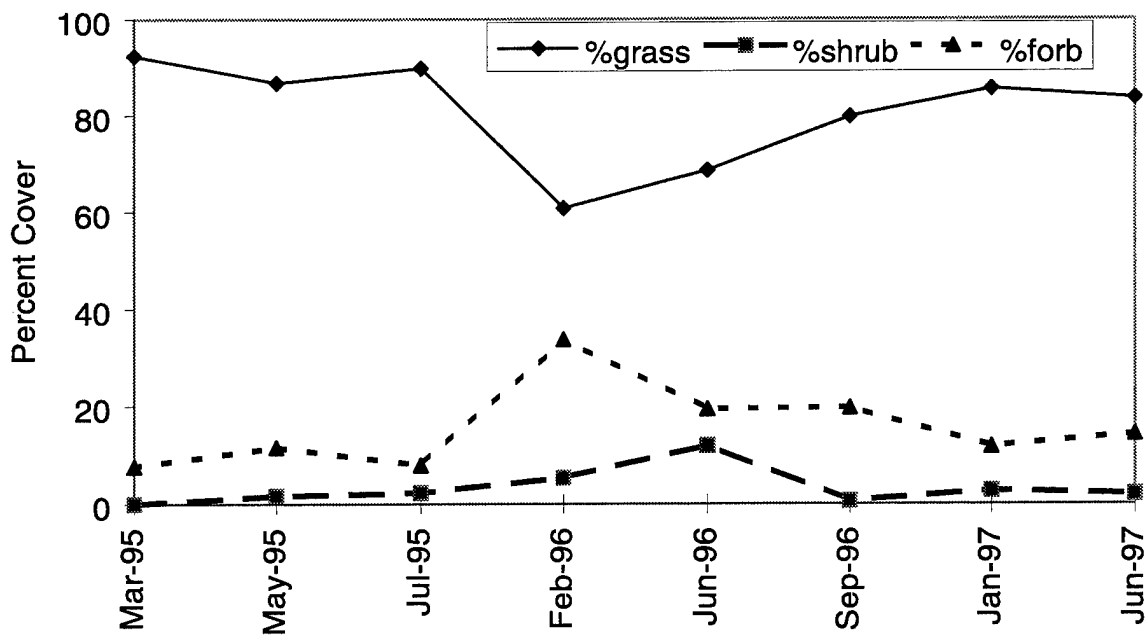


Figure 6. Contribution of vegetation types to live canopy cover at MCBH.

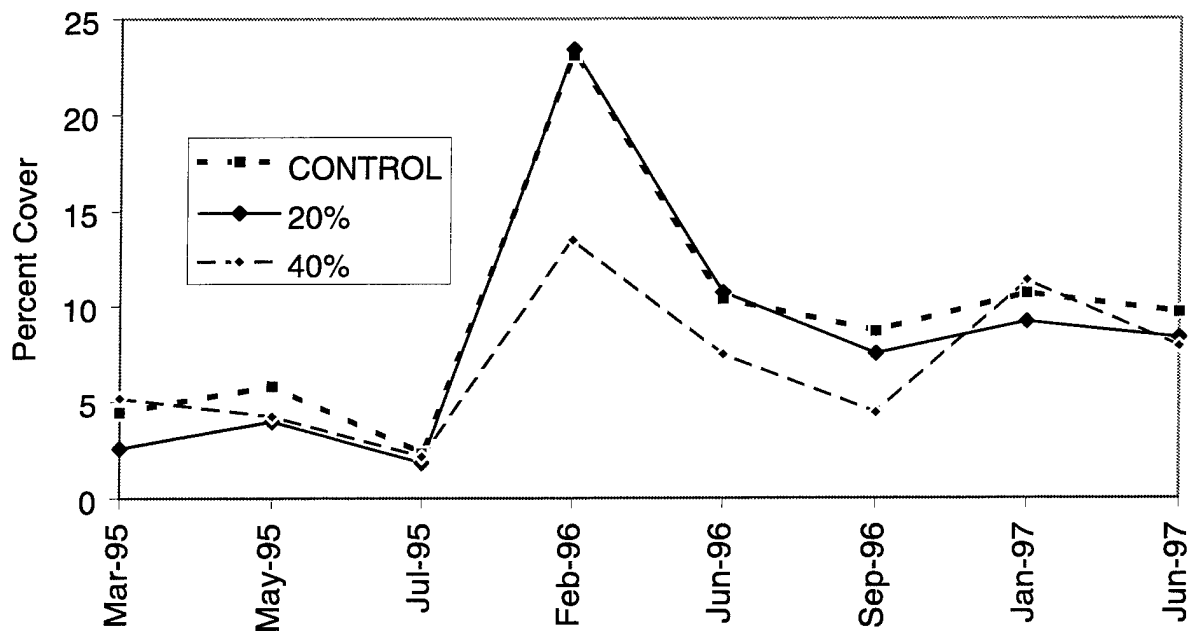


Figure 7. Contribution of forbs to total cover at MCBH.

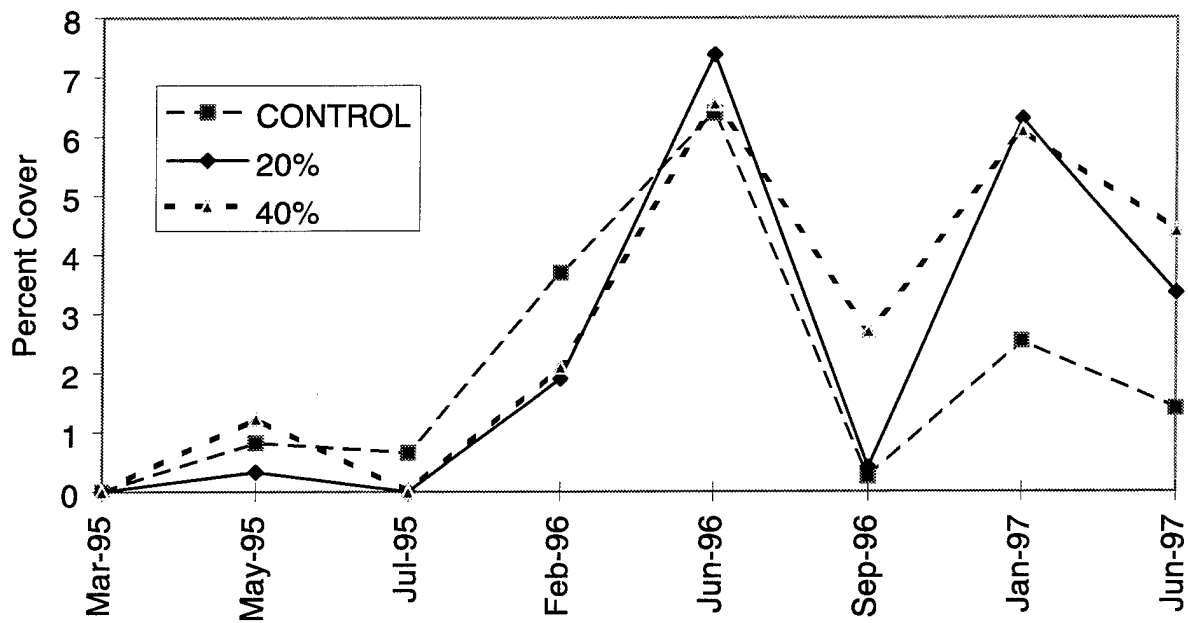


Figure 8. Contribution of shrubs to total cover at MCBH.

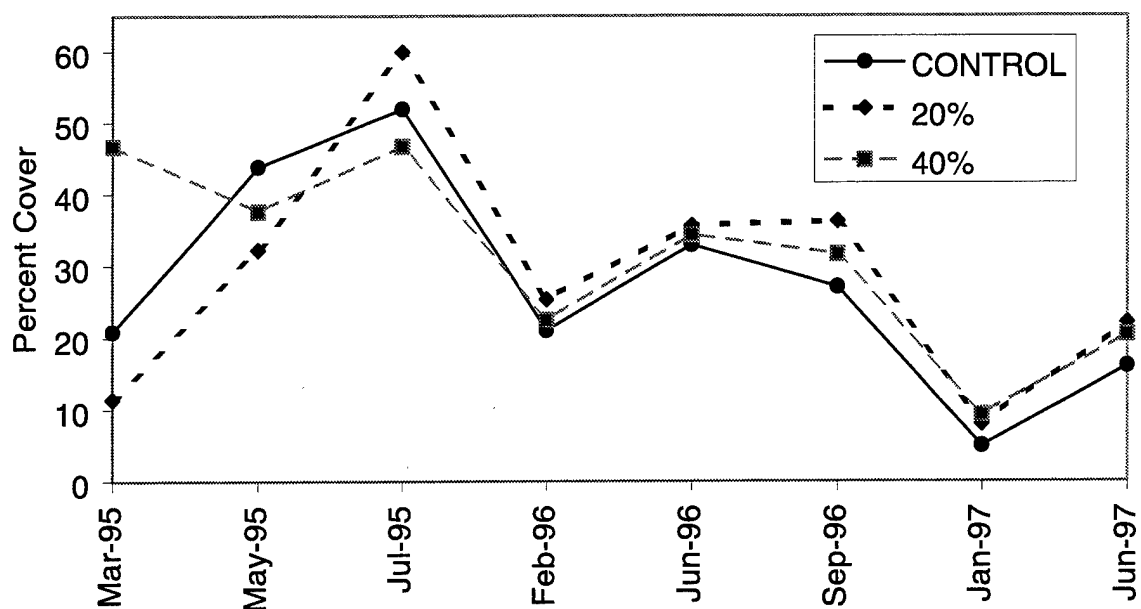


Figure 9. Standing dead versus cover treatment at MCBH.

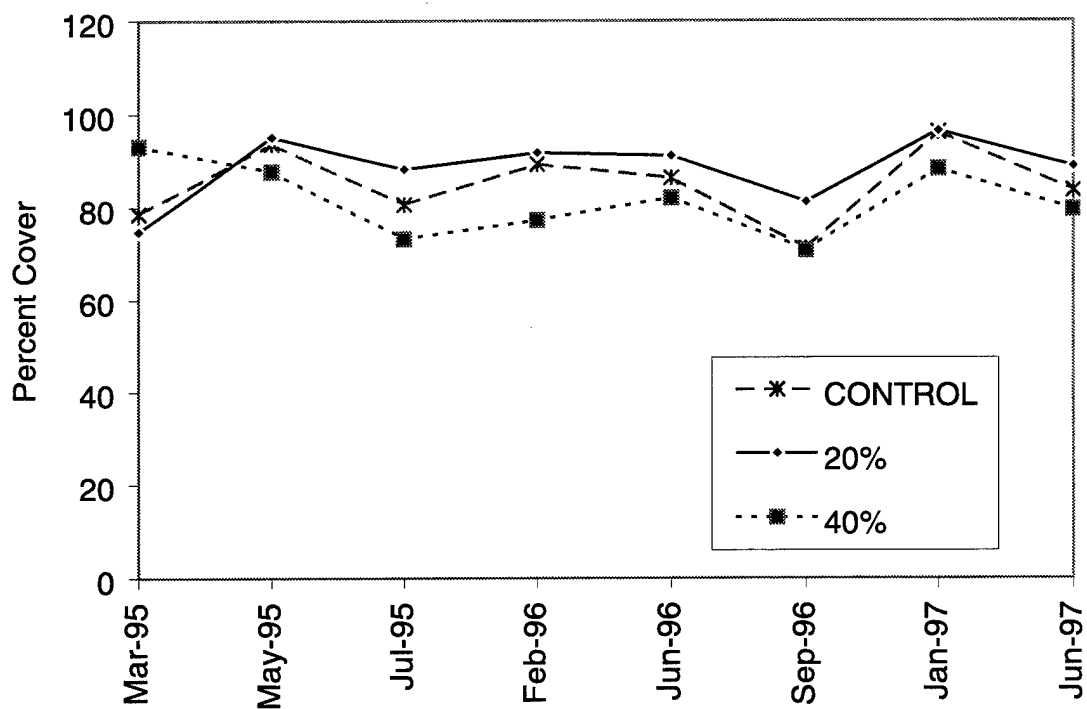


Figure 10. Total canopy cover (Live + Standing Dead) at MCBH.

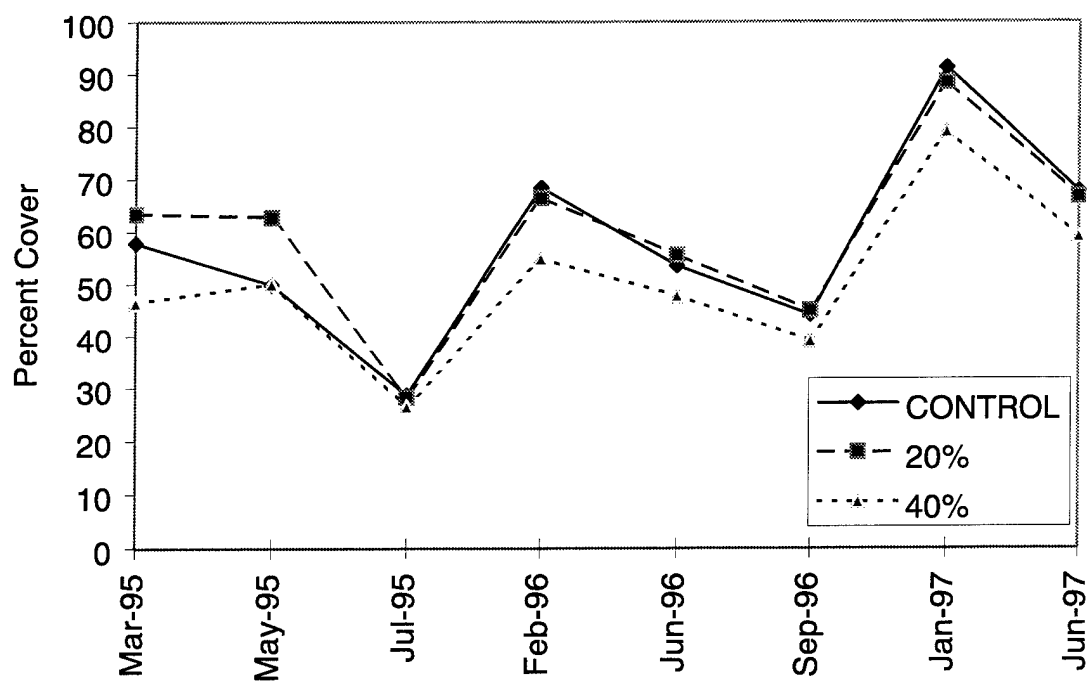


Figure 11. Total live canopy cover at MCBH.

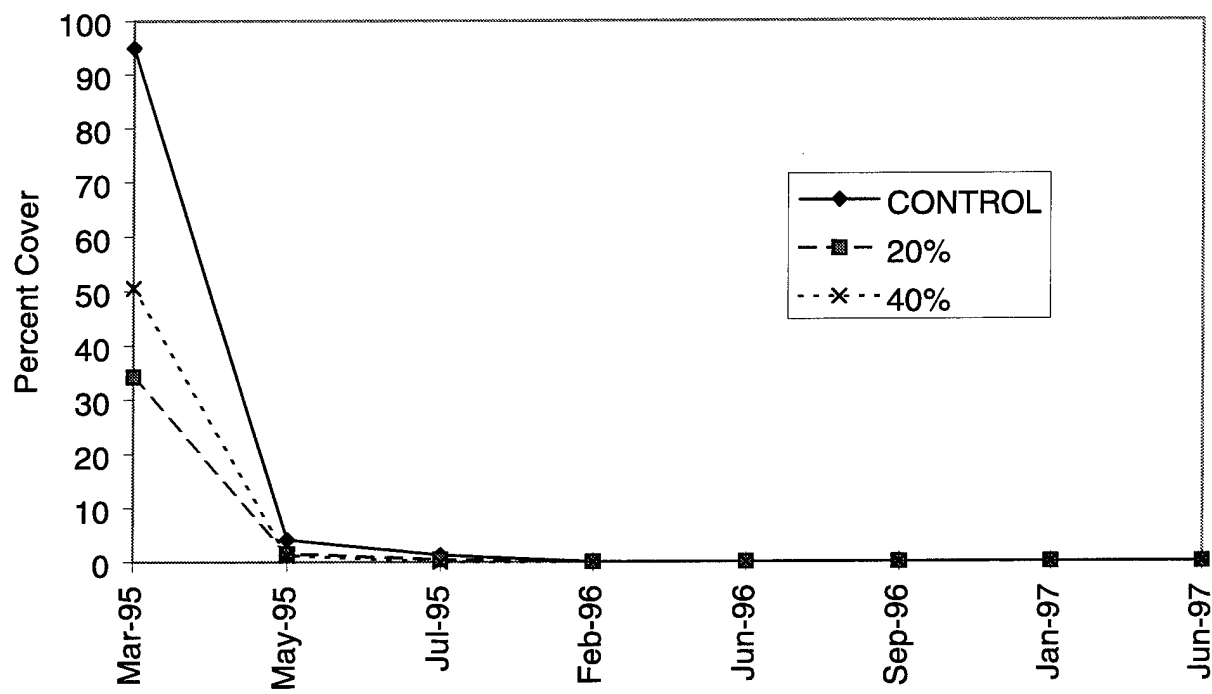


Figure 12. Bare soil versus treatment on MCBH plots.

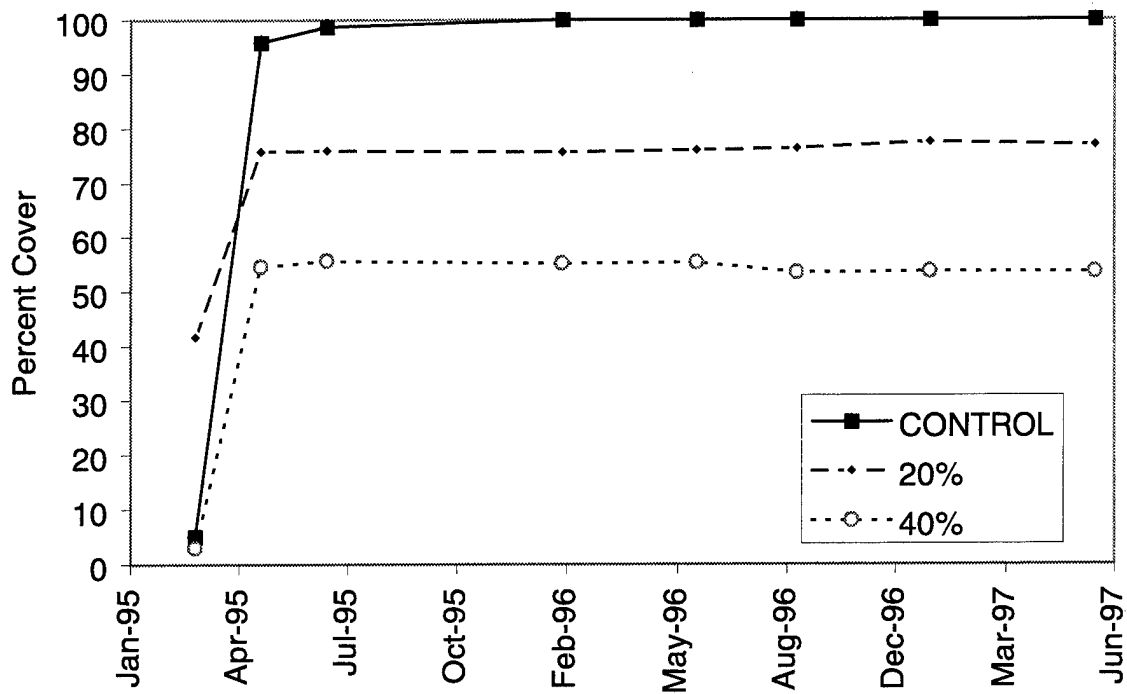


Figure 13. Litter cover versus treatment on MCBH plots.

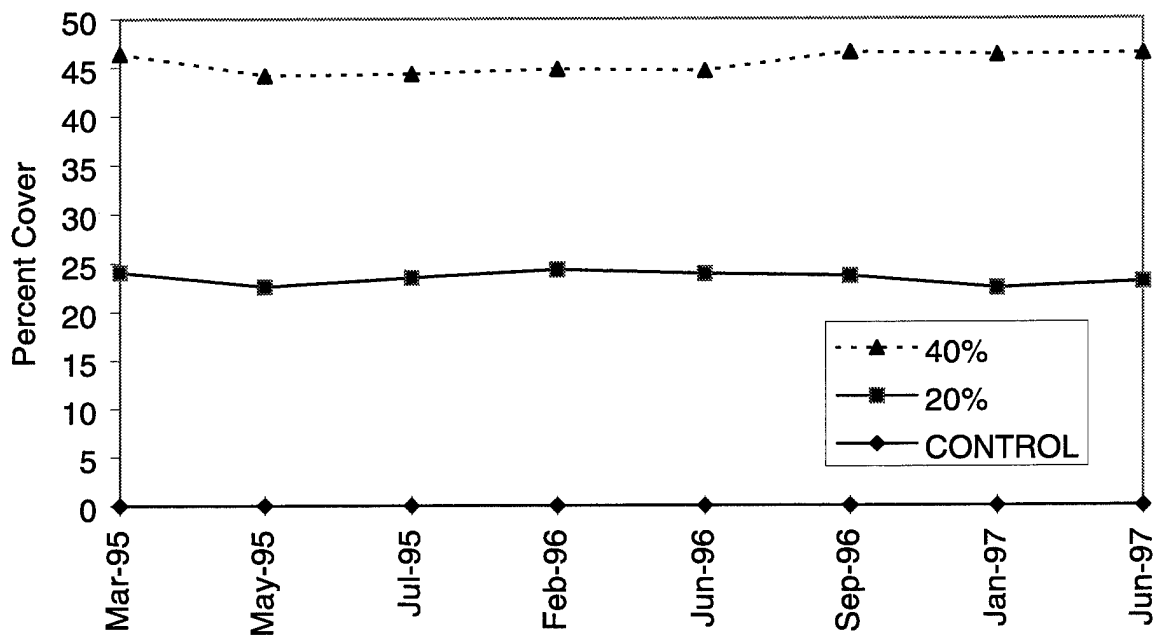


Figure 14. Gutter versus treatment on MCBH plots.

The biomass of vegetation canopy and ground cover is presented in Figures 15-22 and Table 5. Live canopy biomass and total canopy biomass are presented in Figure 23-24. None of the differences in biomass between treatments were significant (grass, $p=0.94$; forb, $p=0.85$; shrub, $p=0.49$; std. dead, $p=0.85$; litter, $p=0.32$; total live canopy vegetation, $p=0.54$; total canopy vegetation, $p=0.73$).

There were no obvious patterns in grass, forb, or shrub cover on the plots with time (Figures 15-20; and Table 5). Most of the biomass associated with live vegetation was due to the grass cover (Figures 15 and 18).

An obvious pattern to the data was that standing dead plant material started out relatively high at the beginning of the study and decreased to constant levels of about 100 g/m^2 in about 1 year (Figures 15-17 and 21). This decreasing importance of standing dead likely reflects the changing vertical structure of the vegetation canopy in that the live plant cover was increasing in height and, thus, was first contacted by the pin during the point frame measurements.

Another obvious pattern to the data was that litter cover increased from zero to a peak value on all cover designs in about 1 year (Figures 15-17 and 22). Litter cover then remained relatively constant at about 400 g/m^2 through the remainder of the study.

The biomass of grass species varied from $50\text{-}250 \text{ g/m}^2$ over the course of the study and averaged about 100 g/m^2 (Figure 18; and Table 5). Forb biomass varied from $0\text{-}120 \text{ g/m}^2$ and averaged about 30 g/m^2 (Figure 19) while shrub biomass ranged from $0\text{-}120 \text{ g/m}^2$ and averaged about 30 g/m^2 (Figure 20). Standing dead biomass ranged from $0\text{-}500 \text{ g/m}^2$ and averaged about 100 g/m^2 (Figure 21) while litter biomass ranged from $0\text{-}1300 \text{ g/m}^2$ and averaged about 400 g/m^2 (Figure 22).

Total live cover ranged from $50\text{-}350 \text{ g/m}^2$ and averaged about $100\text{-}200 \text{ g/m}^2$ (Figure 23). Total cover, to include live and standing dead, ranged from $100\text{-}650 \text{ g/m}^2$ and averaged about 250 g/m^2 (Figure 24). Live cover was variable through the study but generally remained at about $100\text{-}200 \text{ g/m}^2$ while total cover started out high and decreased with time due to the decreases in standing dead plant material.

WATER BALANCE DATA

Precipitation: The distribution and amounts of monthly precipitation predicted with CLIGEN and that measured at MCBH over the last 30 years (Table 6 and Figure 25) were very similar (i.e., $r^2 = 0.77$, 1, 28 df, slope = 1.0, $p < 0.0001$) for the 28 month study period. While the monthly precipitation actually measured at the study site generally tracked 30 year averages, it was much more variable and ranged over an order of magnitude from the average during any given month (Figure 25). The data collected at the study site show that low amounts of precipitation fell in the summer at MCBH (i.e., $<25\%$ fell on the study site during April-October) while about 75% fell in winter (i.e., November-March).

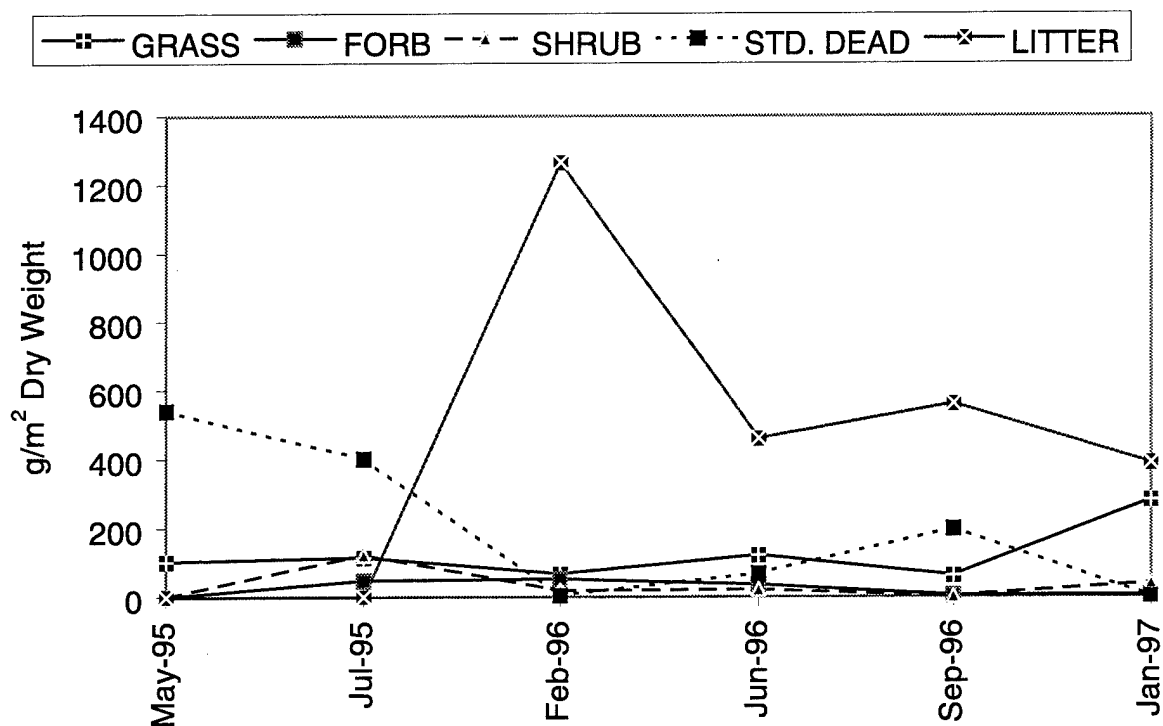


Figure 15. Biomass of plant species on soil plots at MCBH.

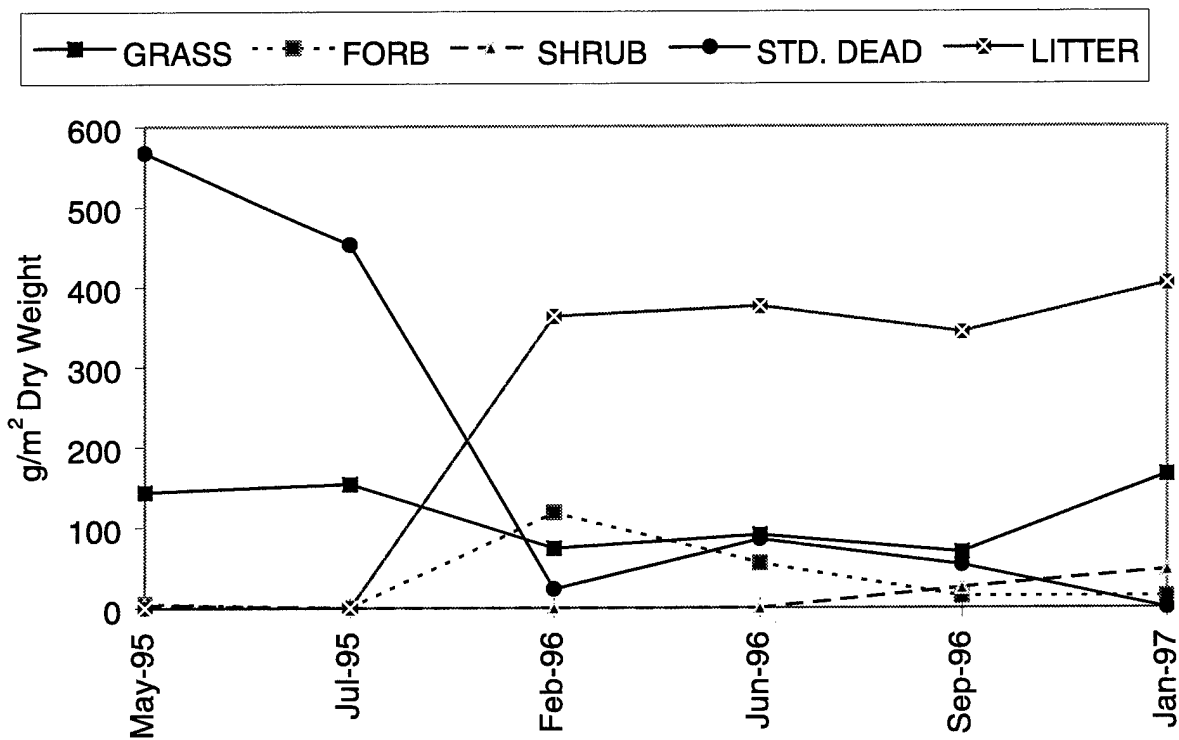


Figure 16. Biomass of plant species on 20% IC plots at MCBH.

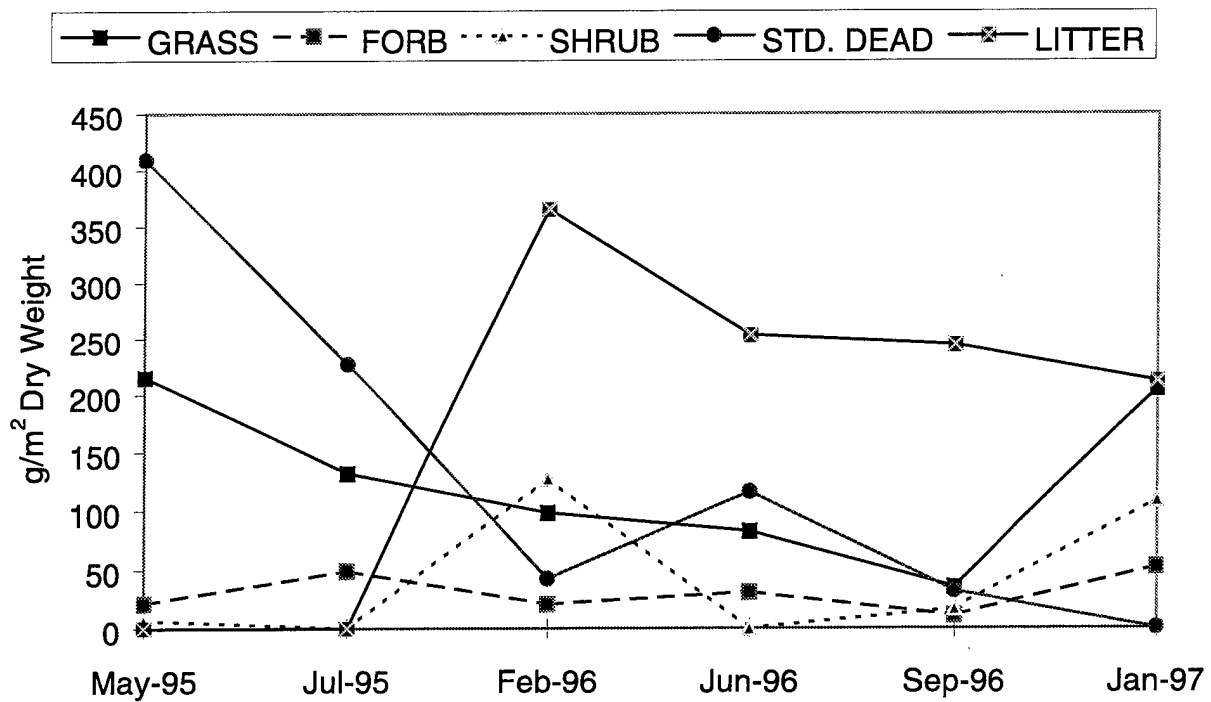


Figure 17. Biomass of plant species on 40% IC plots at MCBH.

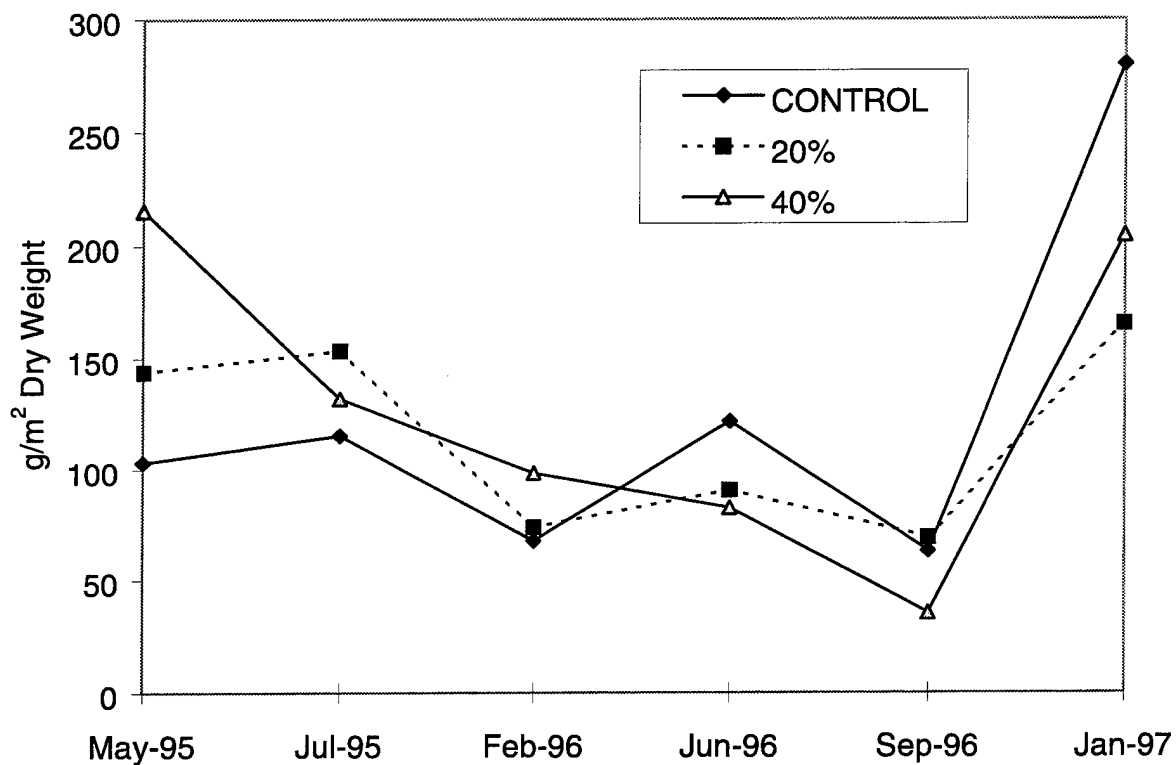


Figure 18. Grass biomass on MCBH cover demonstration plots.

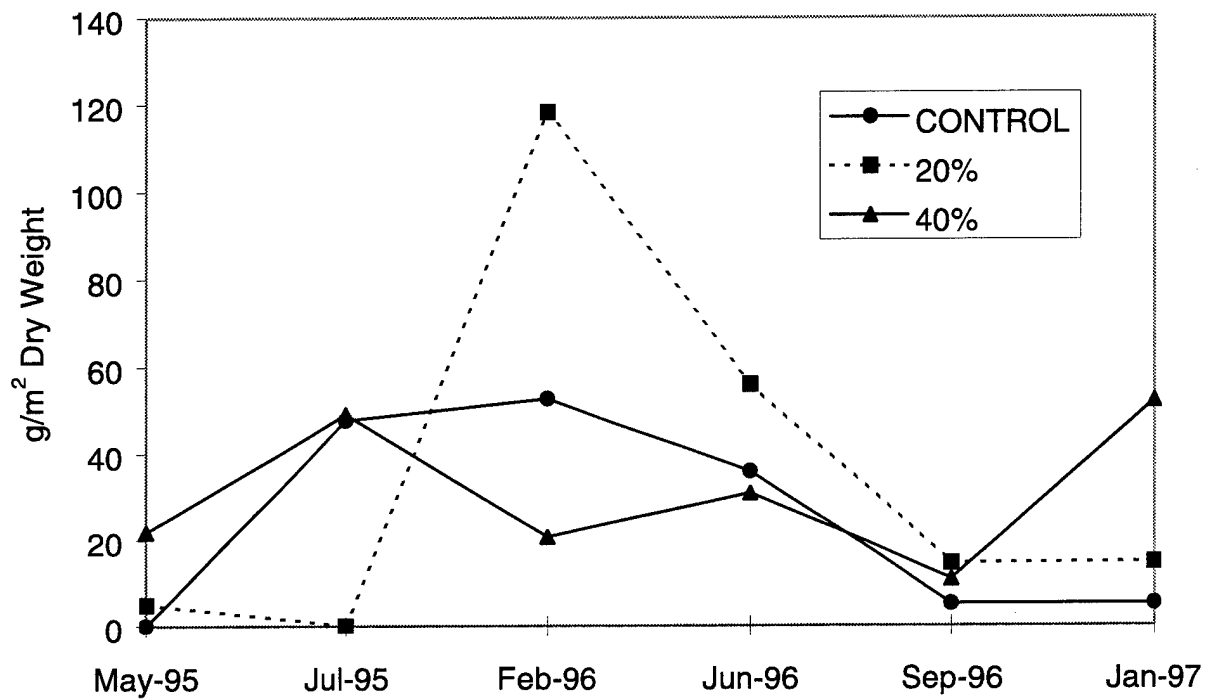


Figure 19. Forb biomass on MCBH cover demonstration plots.

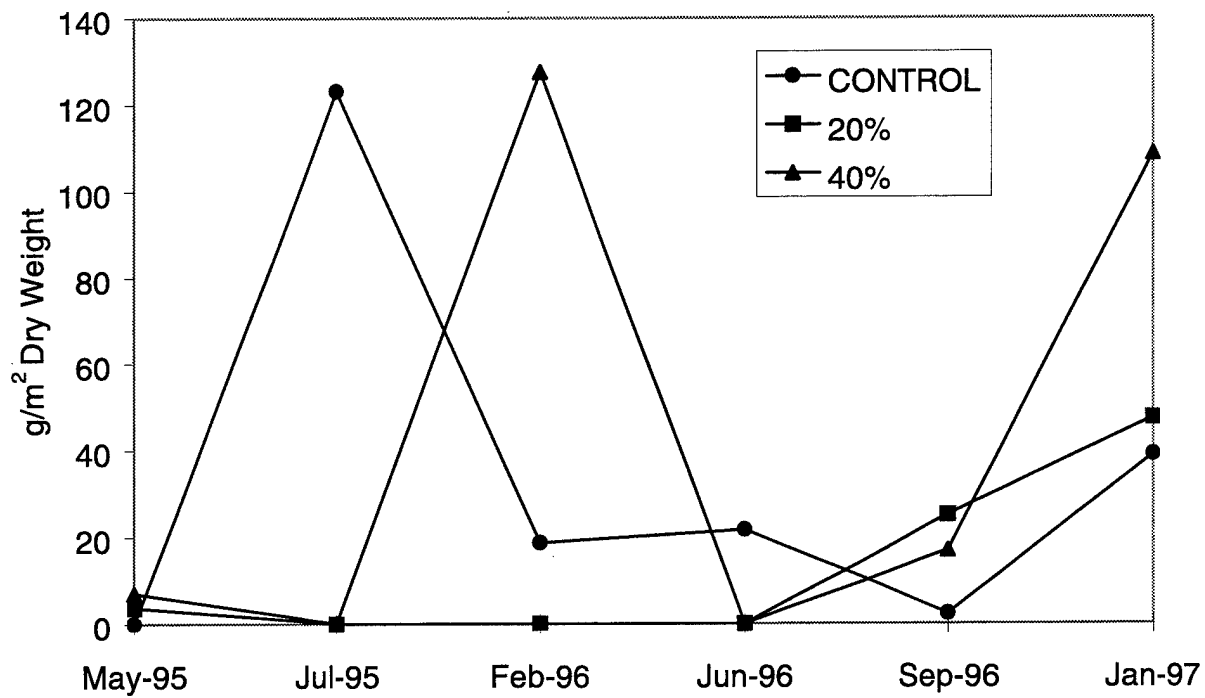


Figure 20. Shrub biomass on MCBH cover demonstration plots.

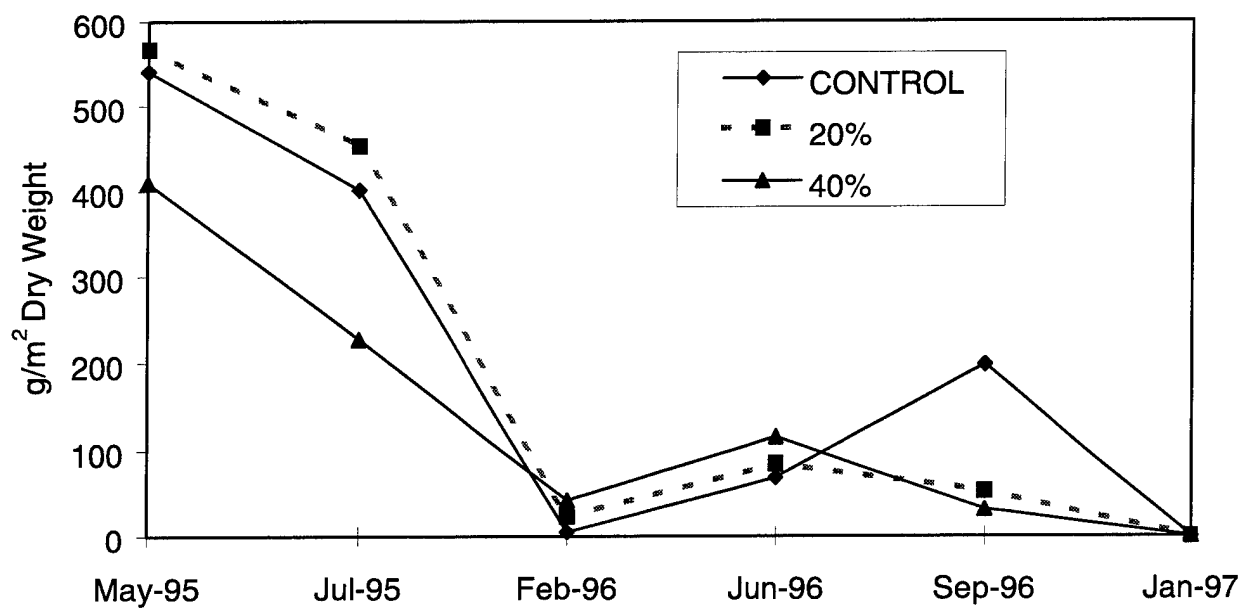


Figure 21. Standing dead biomass on MCBH cover demonstration plots.

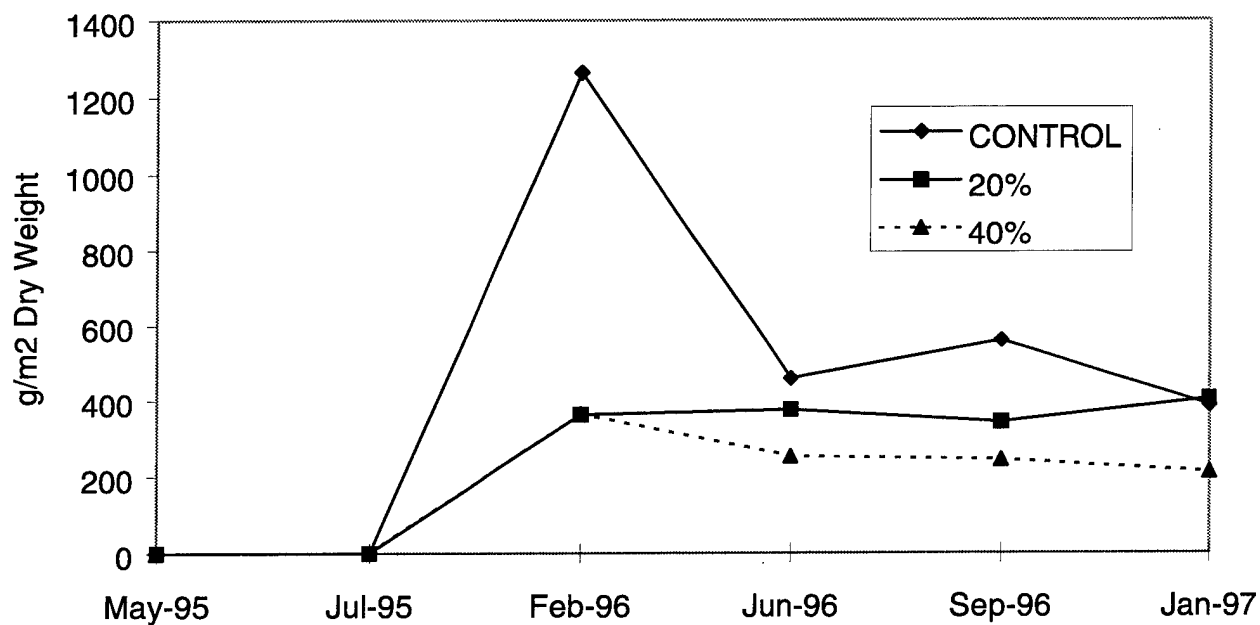


Figure 22. Litter biomass on MCBH cover demonstration plots.

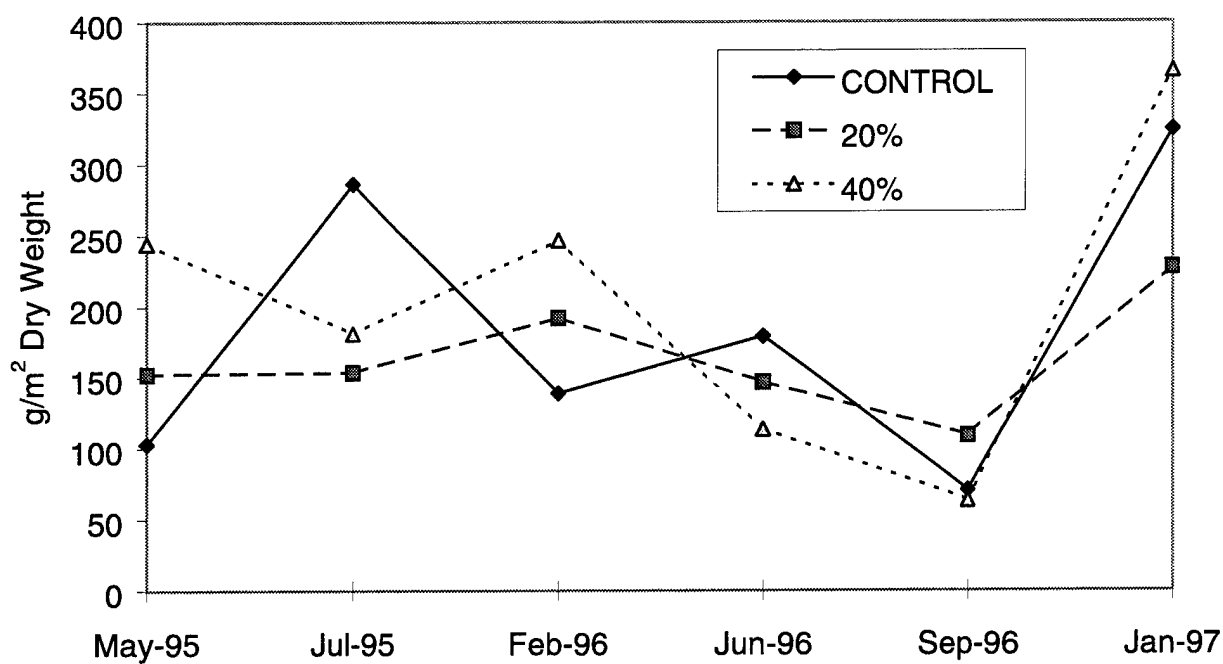


Figure 23. Total live biomass of plant species on control plots at MCBH.

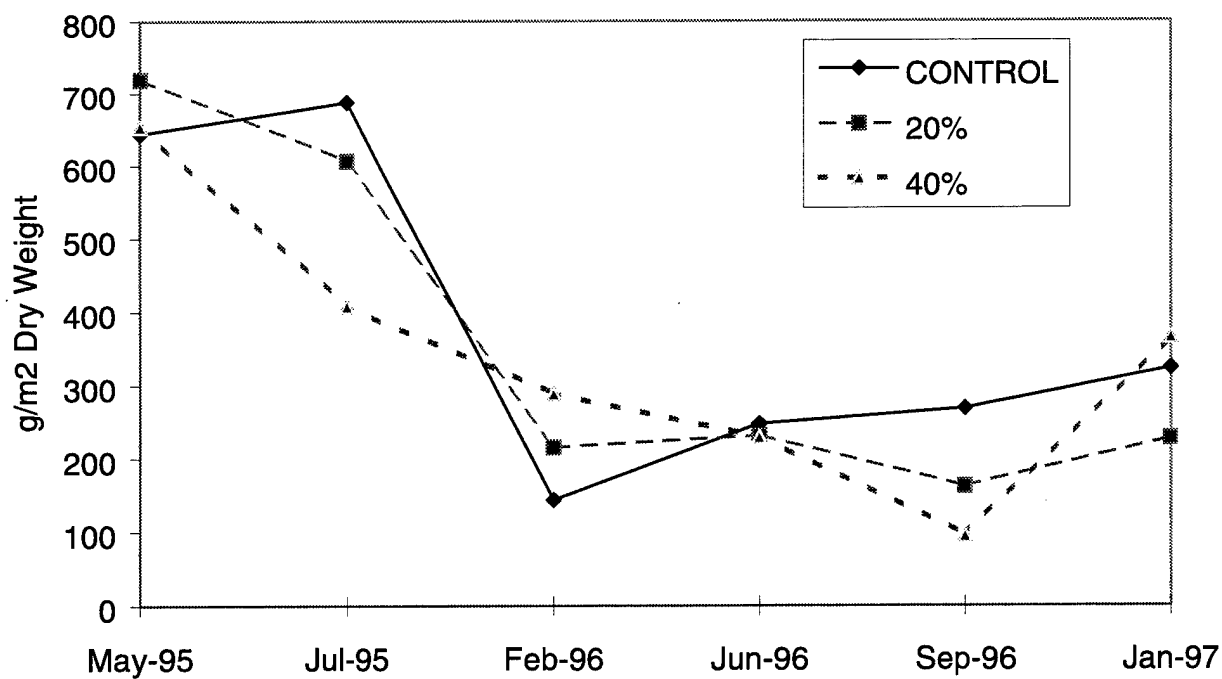


Figure 24. Total vegetative biomass on plots at MCBH.

Table 5. Mean biomass (g/m², air dry) of vegetation canopy cover on the MCBH landfill cover demonstration plots.

	CONTROL		20% IC		40% IC	
	MEAN	STD	MEAN	STD	MEAN	STD
May-95						
GRASS	103	37	144	153	216	327
FORB			5	11	22	49
SHRUB			4	8	7	16
STD. DEAD	541	232	567	246	409	246
Jul-95						
GRASS	115	62	154	98	132	77
FORB	48	117			49	
SHRUB	123	302				
STD. DEAD	401	158	453	158	227	125
Feb-96						
GRASS	68	48	74	103	98	173
FORB	53	64	118	162	21	51
SHRUB	19	28	0	0	128	313
STD. DEAD	5	12	23	26	42	66
LITTER	1265	1365	363	192	366	331
Jun-96						
GRASS	122	85	91	90	82	72
FORB	36	51	56	61	31	72
SHRUB	22	28	0	0	0	0
STD DEAD	69	41	85	50	116	111
LITTER	459	227	376	239	253	122
Sep-96						
GRASS	63	64	69	24	36	27
FORB	5	10	15	23	11	27
SHRUB	2	6	25	39	17	42
STD DEAD	198	240	53	46	32	41
LITTER	561	177	344	136	245	152
Jan-97						
GRASS	280	253	165	130	205	280
FORB	5	12	15	21	52	86
SHRUB	39	89	47	69	109	266
STD DEAD	0	0	0	0	0	0
LITTER	387	294	405	216	212	236

Table 6. Monthly measured and predicted precipitation (cm) at MCBH.

	MEASURED	CLIGEN	30 YR. AVERAGE
Nov-95	8.6	8.0	11.7
Dec-95	4.3	9.6	11.4
Jan-96	20.0	16.7	14.0
Feb-96	2.4	10.8	9.6
Mar-96	12.9	11.1	9.6
Apr-96	1.5	8.5	9.1
May-96	1.0	6.0	5.8
Jun-96	7.3	2.0	3.3
Jul-96	2.7	4.6	4.8
Aug-96	3.4	6.1	4.6
Sep-96	3.1	5.2	4.8
Oct-96	1.0	7.5	7.6
Nov-96	38.5	8.0	11.7
Dec-96	5.6	9.6	11.4
Jan-97	12.6	16.7	14.0
Feb-97	1.3	10.8	9.6
Mar-97	4.9	11.1	9.6
Apr-97	5.0	8.5	9.1
May-97	4.5	6.0	5.8
Jun-97	2.3	2.0	3.3
Jul-97	4.1	4.6	4.8
Aug-97	1.0	6.1	4.6
Sep-97	1.2	5.2	4.8
Oct-97	2.3	7.5	7.6
Nov-97	2.4	8.0	11.7
Dec-97	3.2	9.6	11.4
Jan-98	0.8	16.7	14.0
Feb-98	0.2	10.8	9.6
Mar-98	0.9	11.1	9.6
Sum	158.9	248.5	249.3

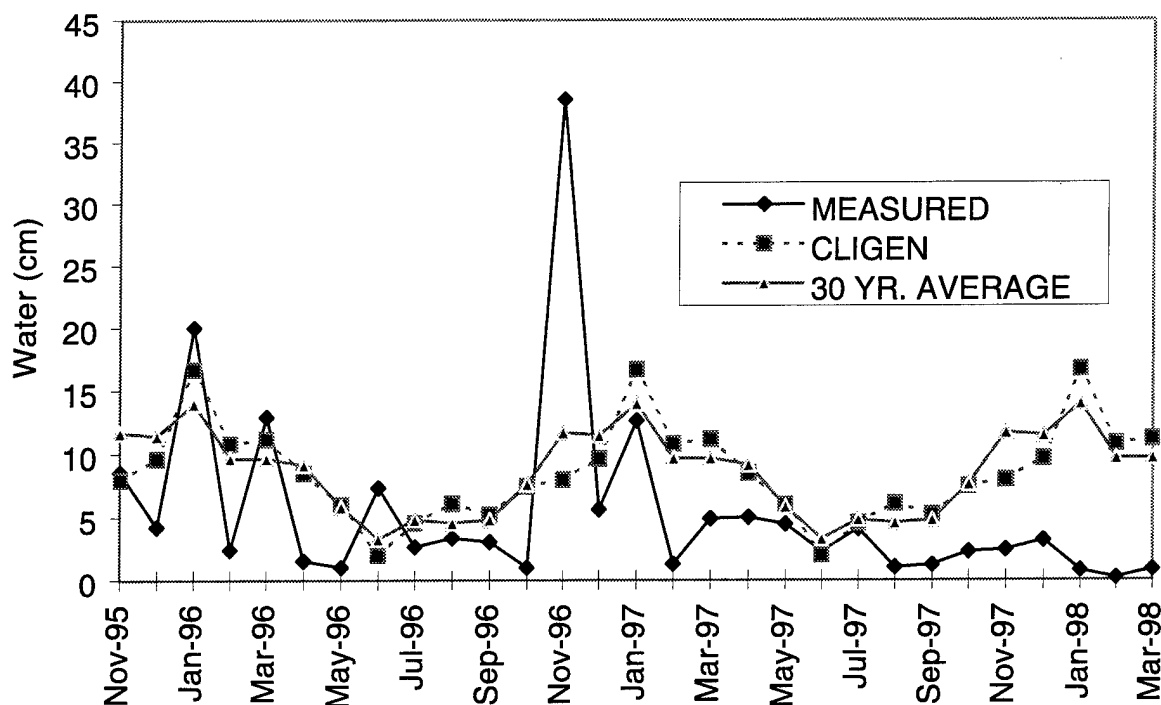


Figure 25. Measured and predicted precipitation at MCBH landfill cover demonstration site.

The total precipitation received at the site from 11/95 - 3/98 was 158.9 cm. This is about 36% less than the 30 year average for the same period of 249 cm, and about 36% below the 249 cm that was predicted by CLIGEN. During the month of November 1996, a large tropical rainstorm at the MCBH study site produced 3.5 times the precipitation than is normally received in that month (i.e., 38.5 cm versus 11.7 cm). Precipitation that fell in November was primarily due to one large storm event which produced about 25% of the total precipitation recorded at the study site during the 28 month period.

Runoff Data: A summary of monthly runoff as measured at the MCBH plots and as calculated using HELP3.0b for the RCRA clay cap design is presented in Appendix I and Figure 26. Differences in total runoff between plot pairs of a given cover design (designated as A and B in Appendix I) were not significant ($p = 0.05$) even though monthly runoff often varied by an order of magnitude. In contrast, differences in runoff between all treatments were significant both within months ($p=0.005$) and between months ($p<0.001$).

The IC cover designs generated as much as 2-5 times more runoff than the soil design for months that had significant runoff and about 2-2.5 times as much over the 28 month study period (Appendix I and Figure 26). There appears to be a clear advantage to using 40% IC over 20% IC since differences in runoff between the two were significant for any of the comparisons made ($p=0.003$). Runoff from the 40% IC treatments averaged about 17% higher than the 20% IC treatment. Runoff from the 20% IC treatment was about twice that of the ET soil cover treatment.

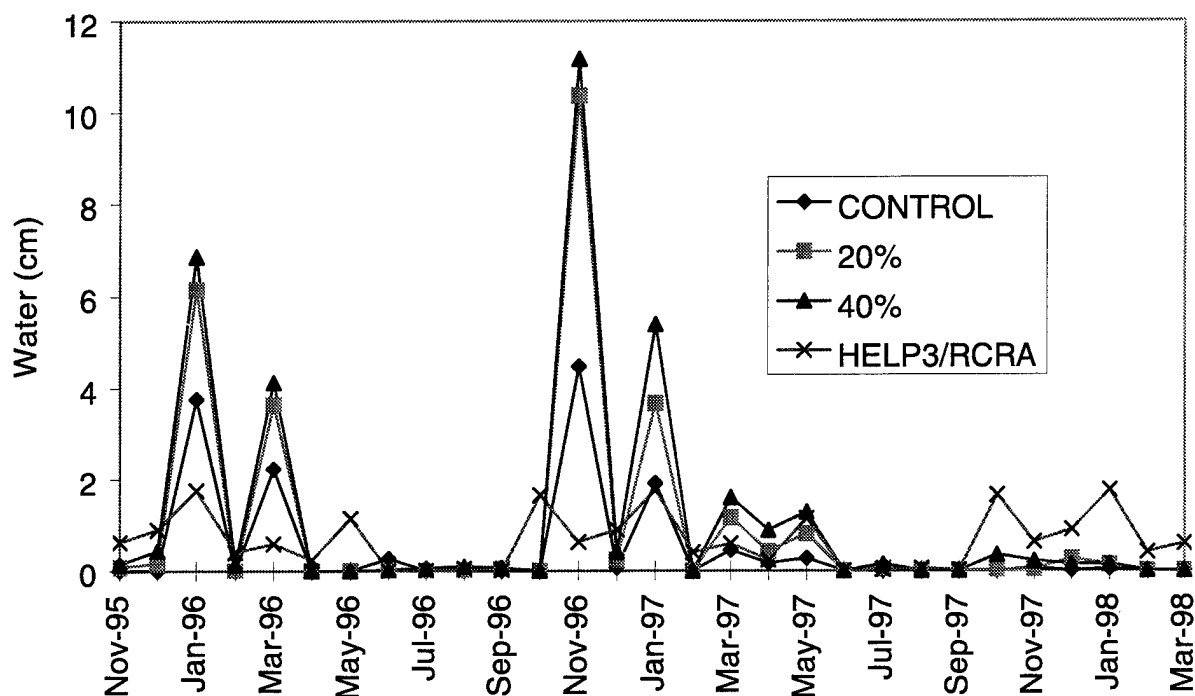


Figure 26. Measured and predicted monthly runoff versus cover treatment at MCBH.

After 28 months, total runoff was 10.5 and 17 cm for the two soil plots, 21 and 33 cm for the 20% treatment, and 29 and 39 for the 40% treatment (Appendix I). Plot pair averages were 13.7, 27.4, and 33.8 cm for the soil, 20%, and 40% cover treatments, respectively (Appendix J). The RCRA cap, based on the HELP3.0b simulations, produced 18.5 cm of runoff over the 28 month period, or about 40% more than the amount measured on the soil plot. Over the 28 month study period, the number of months when average plot runoff was over 0.01 cm ranged from 11 for the soil treatment, 16 for the 20% IC treatment, and 20 for the 40% IC treatment (Appendix J and Figure 26).

Runoff distribution over the 28 month period paralleled that observed for precipitation in that 75% was generated during the months of November-March and 25% during April-October (Appendices I and J; and Figure 26). Linear regression coefficients for predicting runoff from precipitation (Figure 27) were all significant ($p < 0.05$) and multiple correlation coefficients (r^2) were all about 0.9. Based on the slopes of the regression curves, runoff from the soil designs averaged about 14% of the precipitation, 29% for the 20% IC, and 32% for the 40% IC designs. The regression of HELP3.0b predicted runoff versus precipitation (generated with CLIGEN) predicted ($r^2 = 0.39$, $df = 1, 27$, $p = 0.0001$) that the runoff fraction averaged 0.104, or 10.4% of the precipitation (Figure 28).

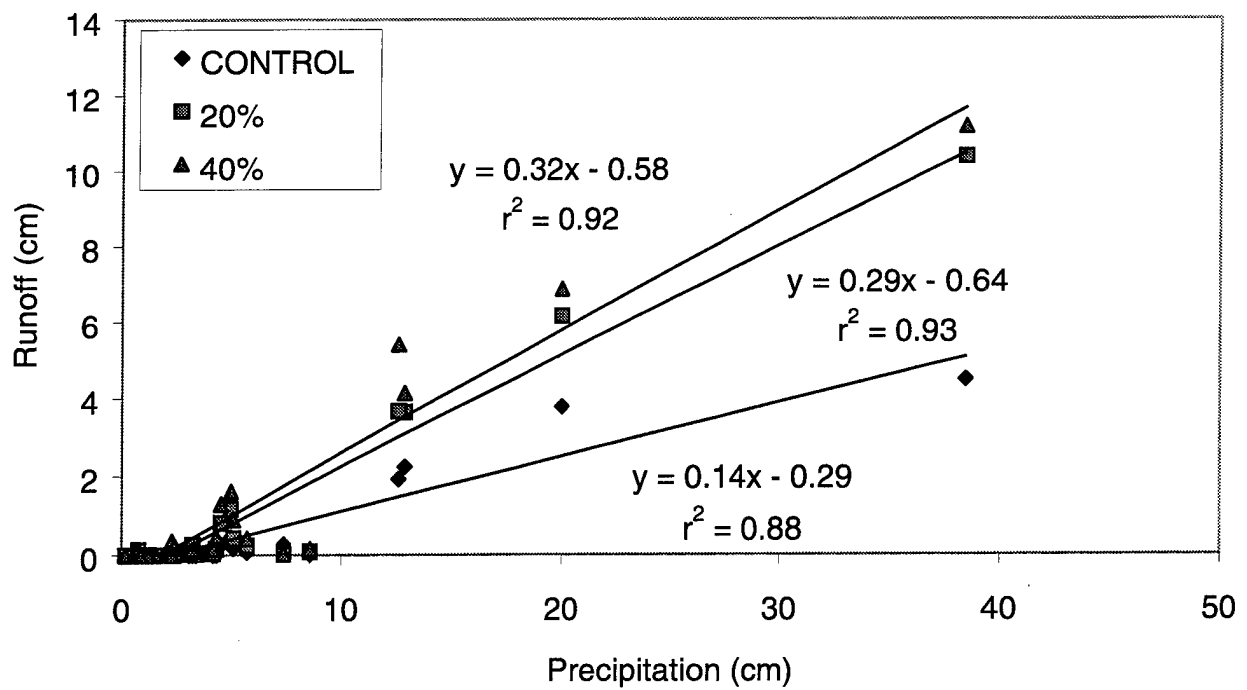


Figure 27. Relationship between measured runoff and precipitation as a function of cover treatment at MCBH.

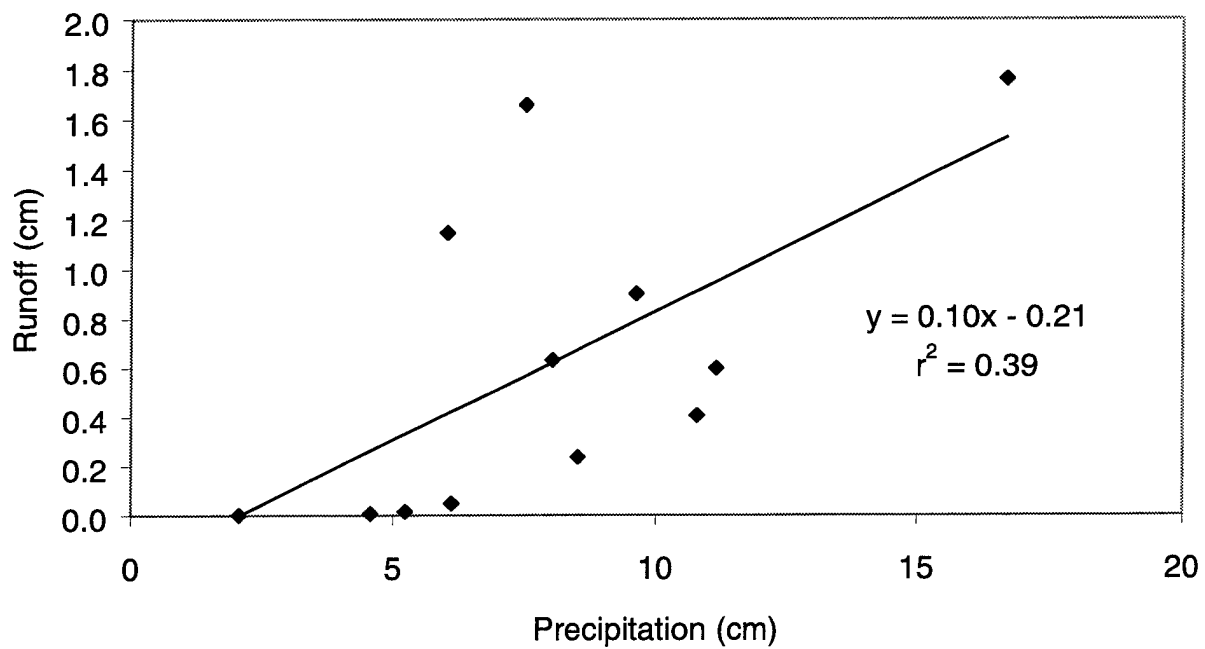


Figure 28. Relationship between HELP3.0b predicted runoff and precipitation for RCRA clay cap at MCBH.

The intercepts of the regressions equations for the MCBH plots and RCRA clay cap simulated with HELP3.0b were all negative ($p < 0.05$) reflecting the fact that below a certain level of precipitation, no runoff was produced (Figures 27 and 28). The amount of monthly precipitation needed to produce runoff (intercept/slope) ranged from about 2-2.5 cm for all four cover designs, including the RCRA clay cap. For example, months that received less than 2 cm of precipitation had essentially no runoff. Conversely, the 4 months that received >10 cm precipitation produced over 80% of the total runoff during the study period.

Over the 28 month period, monthly runoff as a percentage of the precipitation averaged about 11%, 7.4%, 3.4%, and 7.2% from the 40% IC, 20% IC, soil, and predictions for the RCRA designs, respectively (Appendix K and Figure 29). The relative amount of runoff generated by the various cover designs from month to month was as high as 42% and as low as zero reflecting the influence of changing soil moisture status, vegetation phenology, and duration and intensity of individual rain storms.

Soil Moisture Data: The Time Domain Reflectometry (TDR) probes originally placed into the cover plots in late 1994 failed to accurately reflect soil moisture of the plots. They were replaced in early 1996 with 15 cm long probes (4/plot and placed vertically) that were tested for functionality in MCBH soils in the laboratory. However, these probes were only 15 cm long and, thus, did not measure soil moisture throughout the entire 60 cm soil profile that was present in each plot. It has been assumed that measurements taken in the top 15 cm of the soil profile represent the average volumetric water content of the entire 60 cm profile. This assumption likely overestimates the soil water inventory in each plot. In calculating water balance under this assumption, it is likely that the estimates of ET presented later in this report are underestimates.

Average daily soil moisture for each of the 6 plots is presented in Appendix L. The average daily, weekly, and monthly soil moisture by treatment and time is shown in Figures 30-32. The small differences in daily soil moisture by treatment were significant ($p < 0.001$) with the 20% IC treatments having the highest soil moisture contents and the 40% IC the lowest (see Figure 32). These differences were not significant when summarized on a weekly or monthly basis. Overall average soil moisture during the 28 month period was 12.7, 13.2, and 12.2 percent for the soil, 20% IC, and 40% IC designs, respectively.

The pattern of soil moisture changes on all the plots was identical and reflected input of precipitation as shown in Figures 30-32. Seasonal effects on soil moisture were characterized by highs in December-April, when precipitation input was high, and lows in June-September when precipitation was low. Obviously, changes in soil moisture reflect not only precipitation input but also the influence of ET and drainage from the soil profile.

Percolation Data: A summary of monthly percolation as measured at the MCBH plots and as calculated using HELP3.0b for the RCRA clay cap design is presented in Appendices M and N and Figure 33. Differences in percolation between plot pairs A and B of a given cover design were not significant ($p = 0.05$) even though monthly percolation varied by an order of magnitude.

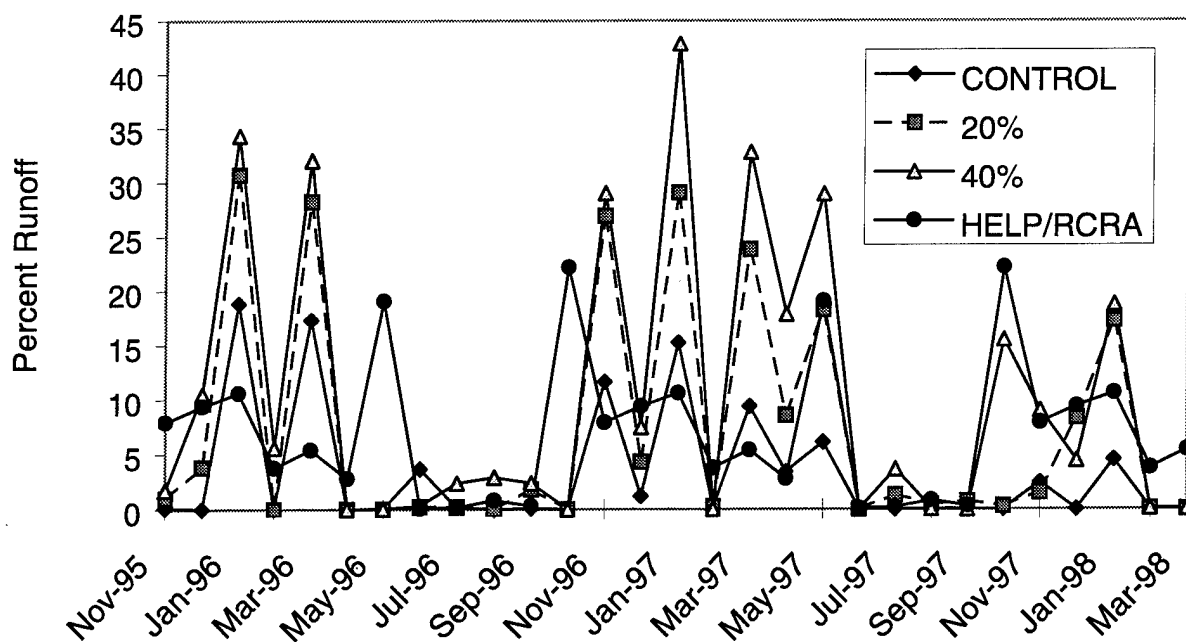


Figure 29. Runoff as a percentage of precipitation from MCBH plots.

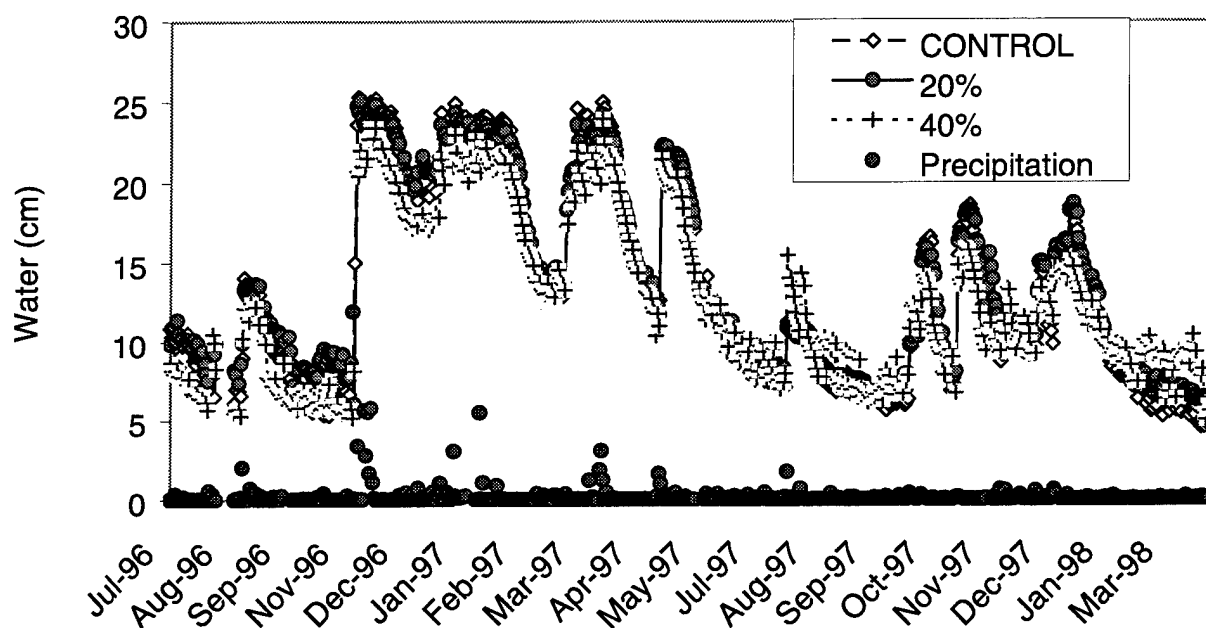


Figure 30. Mean daily soil moisture and precipitation in the surface 15 cm of soil versus cover treatment at MCBH.

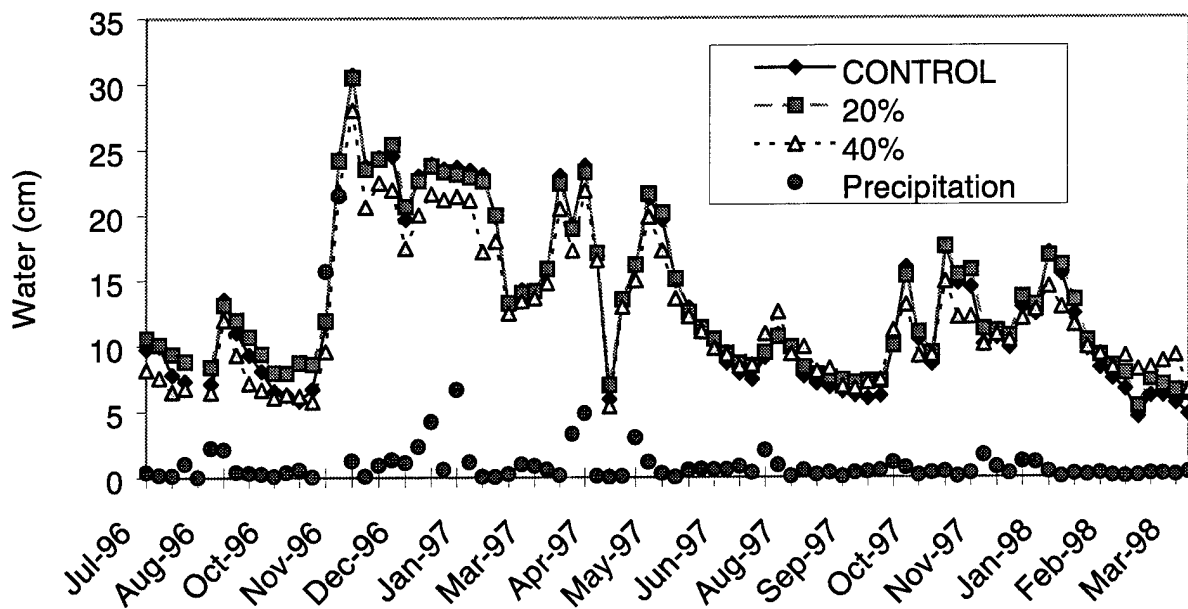


Figure 31. Mean weekly soil moisture and precipitation in the surface 15 cm of soil versus cover treatment at MCBH.

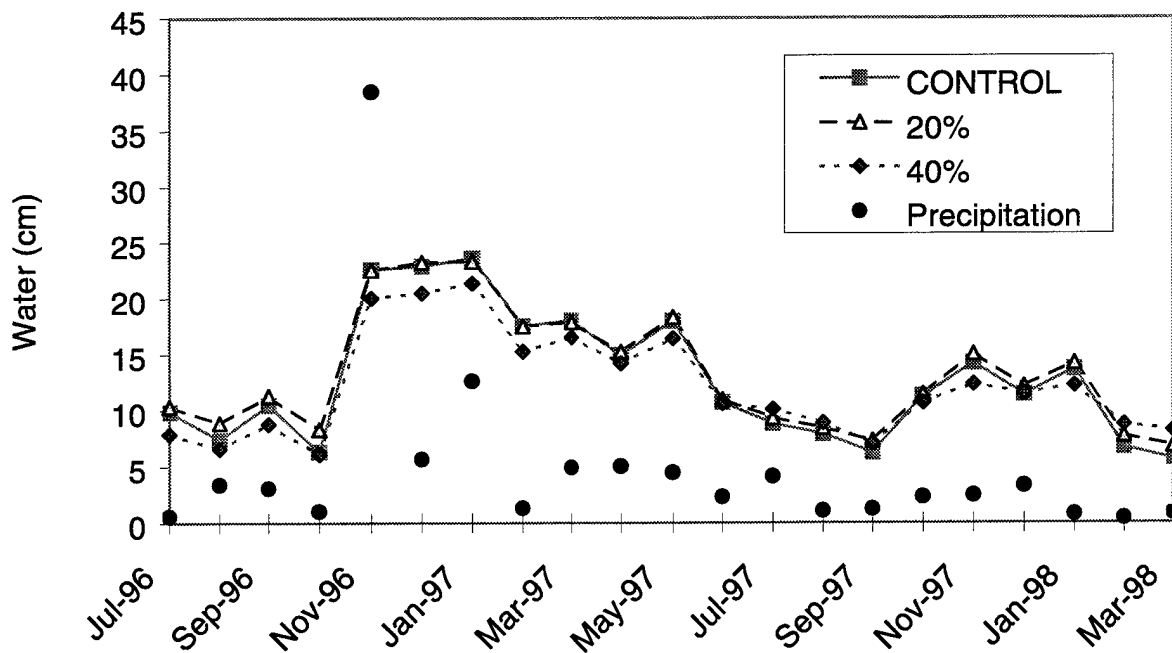


Figure 32. Mean monthly soil moisture and precipitation in the surface 15 cm of soil versus cover treatment at MCBH.

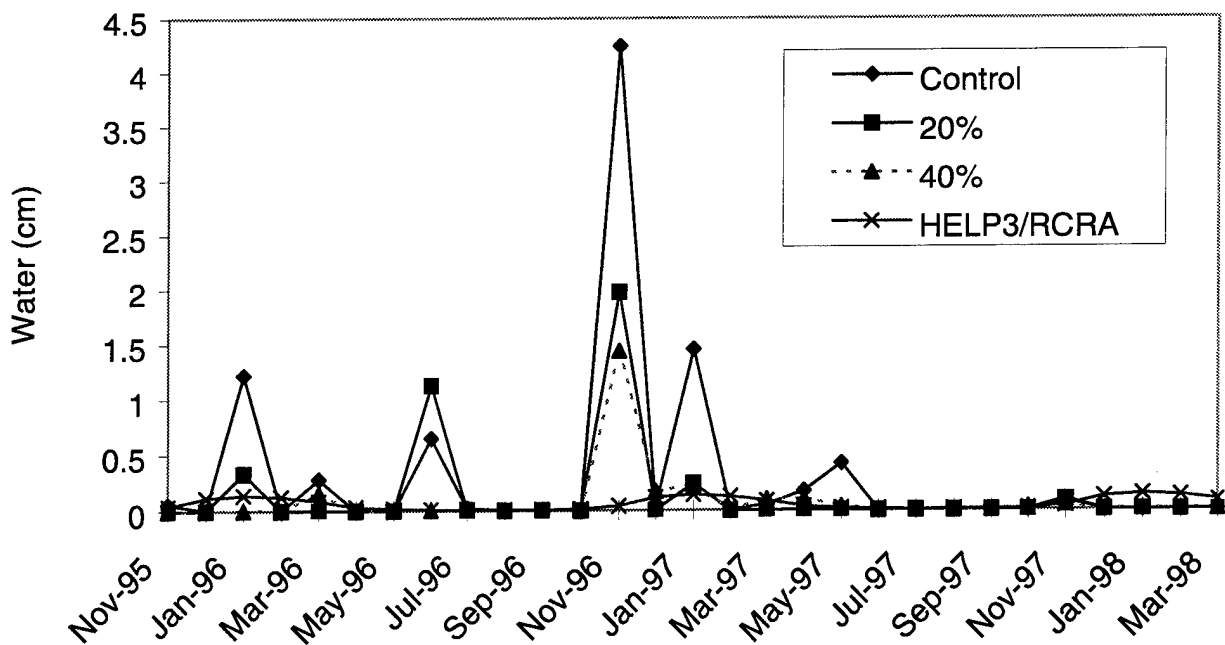


Figure 33. Measured and predicted monthly percolation versus cover treatment at MCBH.

Additionally, percolation from the soil treatment, which totaled 8.7 cm for the 28 month period, was not significantly different from the 20% treatment ($p=0.08$), which produced 3.8 cm of percolation, or from the 40% treatment ($p=0.056$), which produced 2.3 cm of percolation. Despite the large differences in mean total percolation between treatments, the lack of statistical significance was attributed to the large variability and low amounts of percolation for most months during the study period.

After 28 months, total percolation was 14.3 and 3.1 cm for the two soil plots, 6.5 and 1.0 cm for the 20% IC treatment, and 1.9 and 2.7 for the 40% IC treatment (Appendix M). Plot pair averages were 8.7, 3.8, and 2.3 cm for the soil, 20% IC, and 40% IC cover designs, respectively (Appendix N). The RCRA cap, based on HELP3.0b simulations, was estimated to produce 1.7 cm of percolation over the 28 month period (Appendix N).

Percolation distribution over the 28 month period paralleled that observed for precipitation and runoff in that 70-90% on all cover designs was generated during the months of November-March and 10-30% during April-October (Appendices M and N; Figure 33). Depending on cover design, the number of months when percolation was measured ranged from 6-13 over the 28 month study period (Appendix M). As would be expected, the number of months with percolation was higher on the ET soil cover design and lowest on the IC designs (Appendix N). Percolation from the RCRA clay cover was predicted by HELP3.0b to occur in all months except July and September.

Linear regression coefficients relating measured monthly percolation (Y) to measured monthly precipitation (X) are presented in Figure 34. Based on the slopes of the regression curves,

percolation accounted for about 5.8% of the precipitation on the soil design, 2.5% on the 20% IC, and 1.6% on the 40% IC designs. The regression slopes were all significant at $p < 0.001$. The regression slope of 0.012, or 1.2% of the precipitation, for HELP3.0b-predicted percolation versus CLIGEN-predicted precipitation (Figure 35) was also significant ($r^2 = 0.75$, $df = 1, 27$; $p = 0.0001$).

The intercepts of the regression equations relating percolation and precipitation were all negative (Figure 34) reflecting the fact that below certain levels of precipitation, very little percolation was produced. The amount of monthly precipitation needed to produce percolation (intercept+slope) ranged from about 2.5-3 cm for all three cover designs. Thus, months that had less than about 3 cm of precipitation produced no percolation. Examples include the months of April, May, August, and October. As with runoff, from 55-90% of the percolation measured during the study period was associated with the 4 months where precipitation exceeded 10 cm. Model predictions for the RCRA clay cap design indicated that about 4 cm of precipitation was needed to produce percolation through the clay cap (Figure 35).

Over the 28 month period, the relative amount of monthly percolation, as a percentage of the precipitation, averaged 0.8%, 1.0%, 2.1%, and 0.6% from the 40% IC, 20% IC, control, and simulated RCRA designs, respectively (Appendix O; Figure 36). On a month to month basis, the relative amount of percolation generated by the various cover designs was as high as about 16% and as low as zero reflecting the influence of changing soil moisture status, vegetation phenology, and duration and intensity of individual rainstorms.

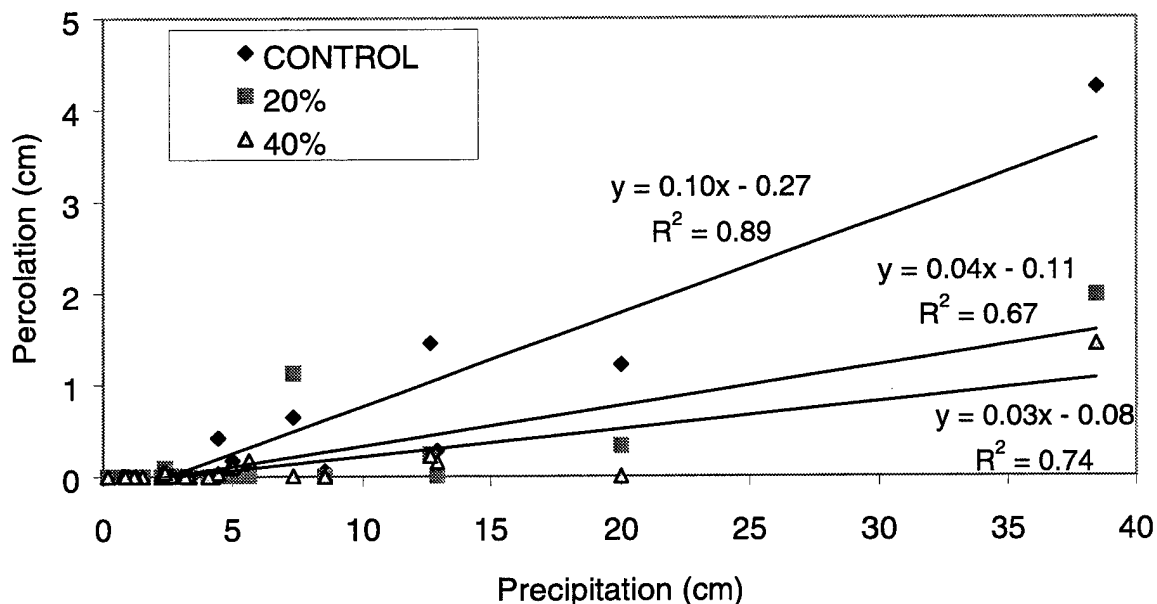


Figure 34. Relationship between measured percolation and precipitation as a function of cover treatment at MCBH.

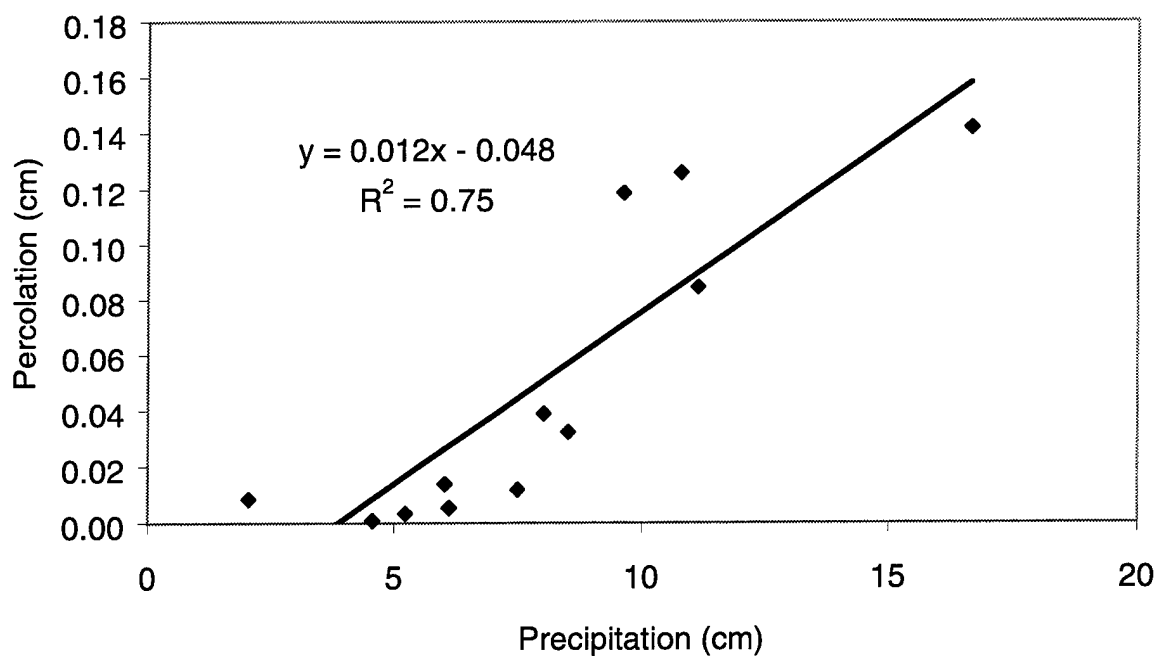


Figure 35. Relationship between HELP3.0b predicted percolation and precipitation for RCRA clay cap at MCBH.

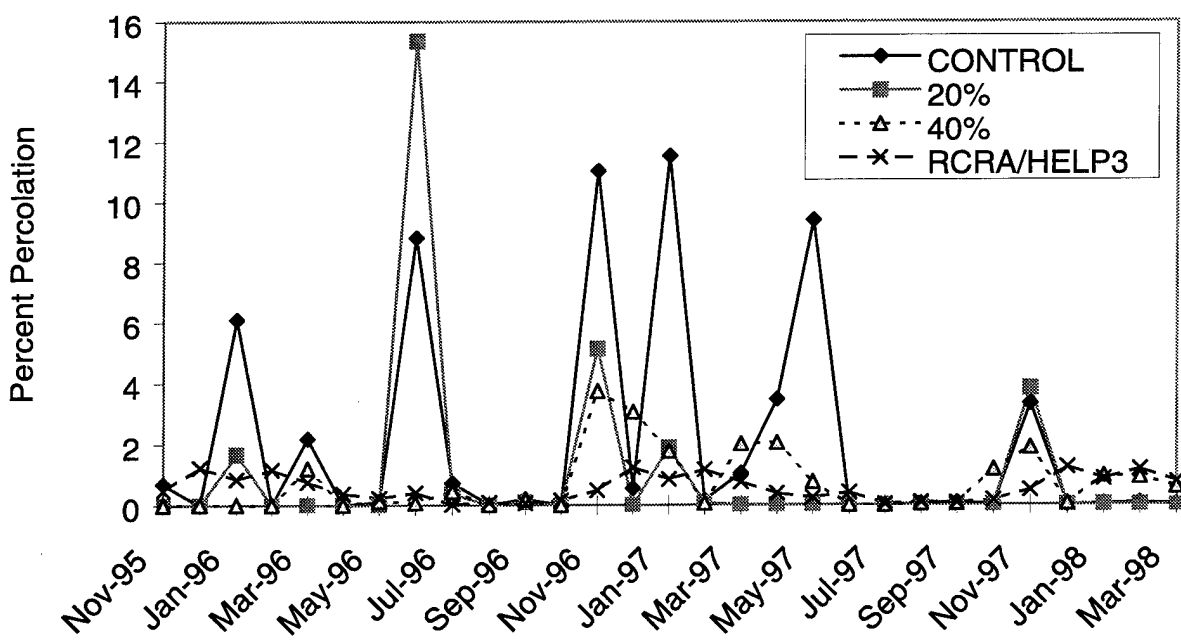


Figure 36. Percolation as a percentage of precipitation at MCBH.

Water Balance Analysis: A complete water balance analysis of each cover design was attempted using data collected from July 1996 through March 1998, a 21 month period. Recall that soil moisture data were unreliable before July 1996 and measurements after this date only reflect soil moisture in the surface 15 cm of each cover profile even though the following analysis assumed the soil moisture data was representative of the entire soil profile. A water balance for each plot was constructed by solving Equation 1 (see pg. 2) for ET using monitoring data for all the other terms in the equation. All measurements were converted to a common unit of depth (cm) for the calculations. A daily, weekly, and monthly water balance was calculated and results for treatment averages are presented in Appendices P-R.

Monthly water balance calculations for the various treatments are shown in Figures 37-39. Clearly the rainstorm in November 1996 had a major influence on the hydrologic response of the various cover treatments. All terms in the water balance equation peaked in November 1996 for each cover design. Seasonal patterns were also apparent showing winter highs and summer lows in the magnitude of all water balance terms.

The estimates of ET and ET as a percentage of the precipitation for the 3 cover designs from 7/96 -3/98 are presented in Figures 40-41 and Table 7. Clearly, ET is an important process in controlling percolation of water through a landfill cap since nearly 100% of the precipitation that fell during most months at MCBH was removed from the soil and returned back to the atmosphere by ET. Over the entire study period (from 11/95 - 3/98), ET was estimated by taking the total precipitation that fell on the plots and subtracting runoff to obtain the amount that infiltrated into the cover soil and then subtracting percolation to estimate the amount of water that was removed from the soil by ET. Results show that of the 158.9 cm of precipitation that fell on the MCBH plots during the study, the amount of runoff averaged 13.7 cm, 27.3 cm, and 33.8 cm for the soil, 20% IC, and 40% IC designs, respectively. Therefore, the amount of precipitation that infiltrated into the various cover designs was 145.2 cm, 131.6 cm, and 125.1 cm for the soil, 20% IC, and 40% IC designs, respectively. Given that percolation was 8.7 cm, 3.8 cm, and 2.3 cm for the soil, 20% IC, and 40% IC designs (see Appendix N), then the amount that was removed by ET was calculated to be 136.5 cm, 127.8 cm, and 122.7 cm for the soil, 20% IC, and 40% IC designs, respectively. This corresponds to removal of about 86%, 80%, and 77% of the precipitation by evapotranspiration that fell on the soil, 20% IC, and 40% IC designs, respectively (Tables 7 and 8).

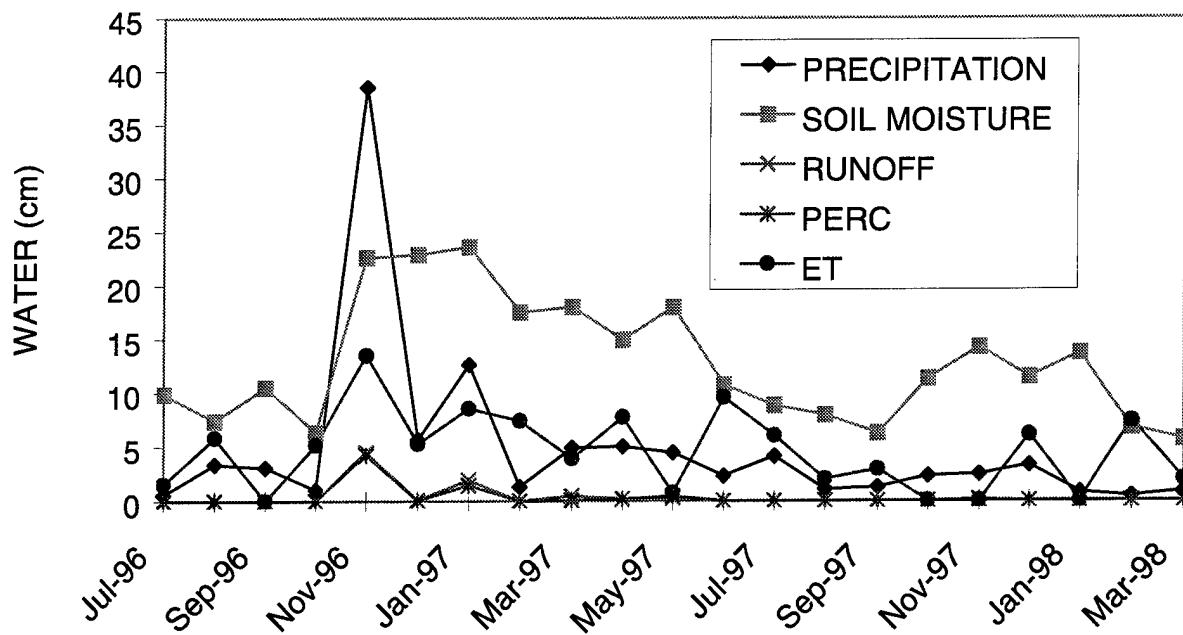


Figure 37. Water balance for ET soil cover design at MCBH.

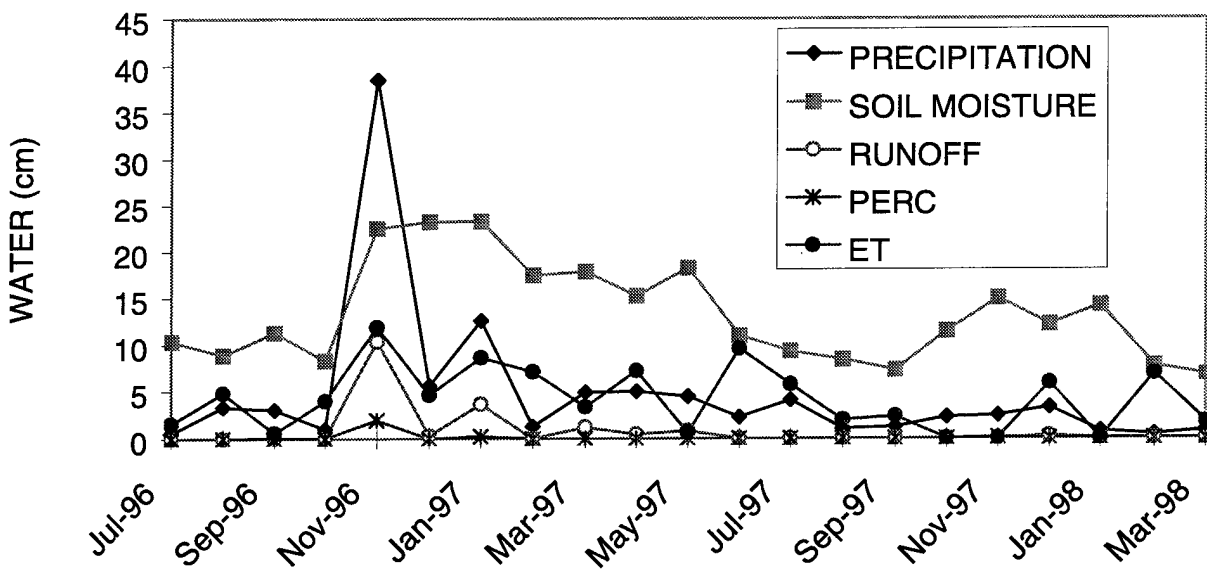


Figure 38. Water balance for 20% IC cover design at MCBH.

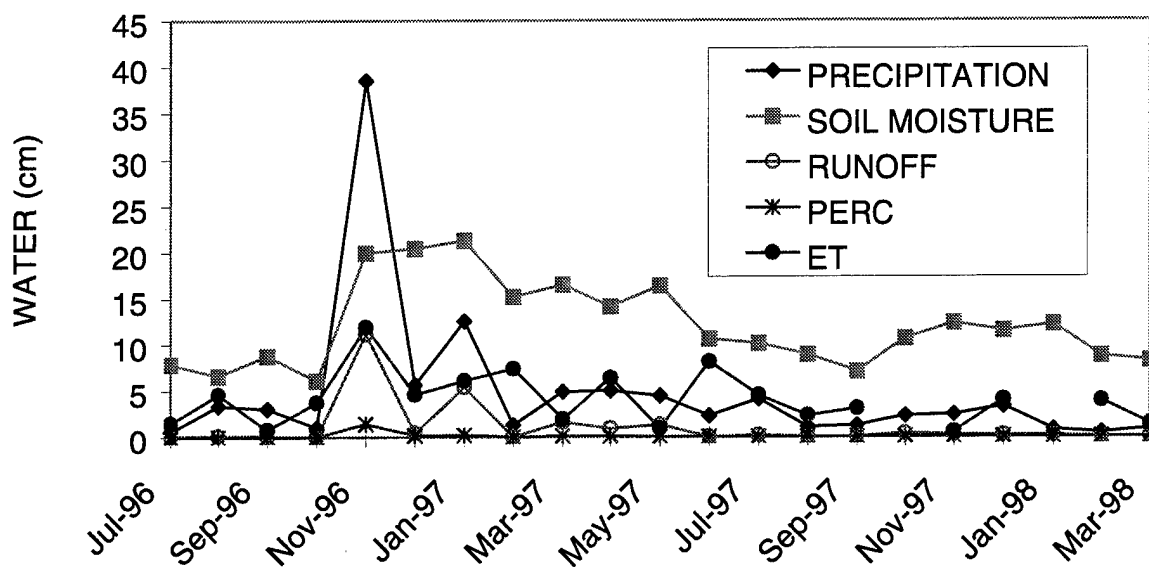


Figure 39. Water balance for 40% IC cover design at MCBH.

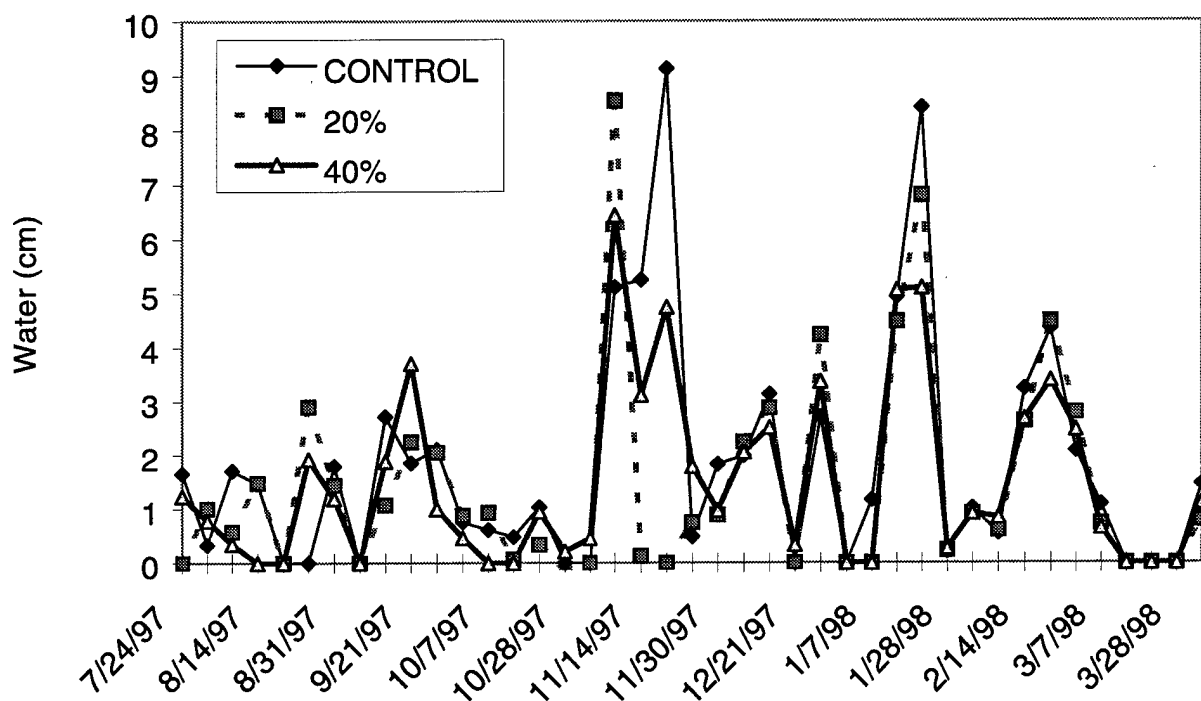


Figure 40. Comparison of ET estimates based upon weekly water balance estimates for landfill cover designs at MCBH.

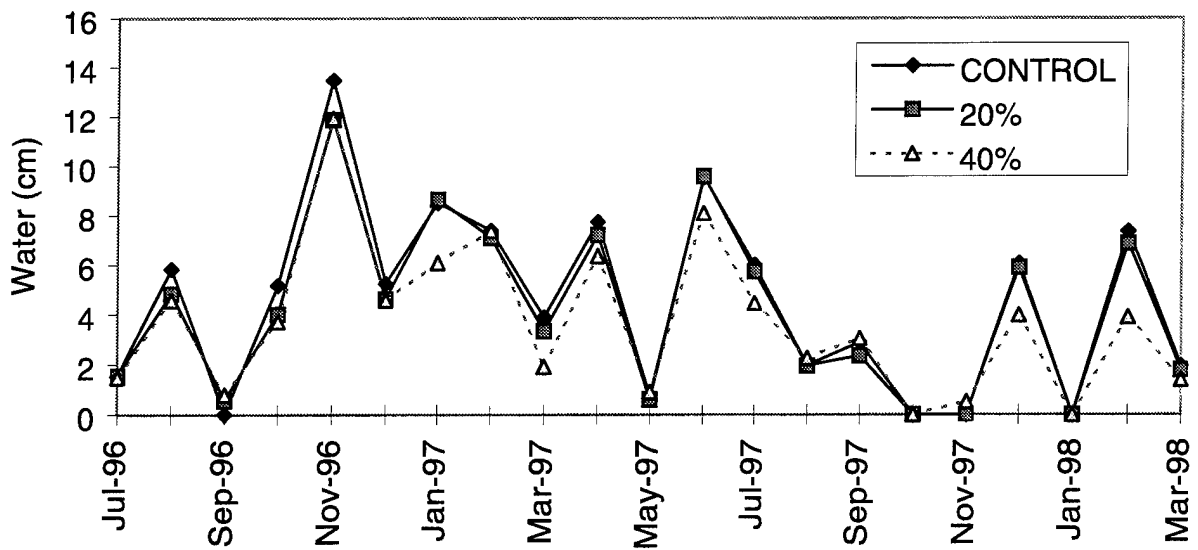


Figure 41. Comparison of ET estimates based upon monthly water balance estimates for landfill cover designs at MCBH.

Table 7. Measured percent ET at MCBH and estimated percent ET RCRA clay cap.

	Control	20% IC	40% IC	RCRA
July-96	99	99	95	96
August-96	100	100	98	90
September-96	0	91	91	97
October-96	100	100	100	67
November-96	61	49	49	55
December-96	98	94	89	90
January-97	72	69	52	63
February-97	100	100	100	96
March-97	88	74	53	89
April-97	96	94	86	109
May-97	52	43	41	78
June-97	100	100	100	116
July-97	100	100	97	96
August-97	100	100	100	90
September-97	100	100	100	97
October-97	0	0	0	67
November-97	0	0	66	55
December-97	100	96	97	90
January-98	0	0	0	63
February-98	100	100	100	96
March-98	100	100	100	89

Table 8. Summary of water balance for July 1996-March 1998 (cm water)

Cover Design	Precipitation (P)	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET	% ET
Control	99	-5	7	6	91	92
20% IC	99	-5	17	2	85	86
40% IC	99	-1	22	2	76	77
RCRA Clay ¹	175.8	2.4	9.3	1.2	143.9	82

¹ Lateral drainage from clay barrier averaged 19 cm during the period.

SUMMARY AND CONCLUSIONS

The relative performance of the various cover types in effecting runoff and percolation during the study is summarized in Figure 42. These results, based upon 28 months of field monitoring data, support the concept of using runoff enhancement to manage percolation of water through a landfill. For example, runoff increased and percolation decreased by a factor of 2-3 on the IC cover designs over that measured on the ET soil cap design (Figure 42). Differences in percolation were significant at $p=0.1$, due to high variability associated with the large range in precipitation events. Statistical tests also indicated that there was some advantage to using 40% runoff enhancement over 20% as the 40% IC design produced significantly more runoff ($p=0.008$) and less percolation ($p=0.056$).

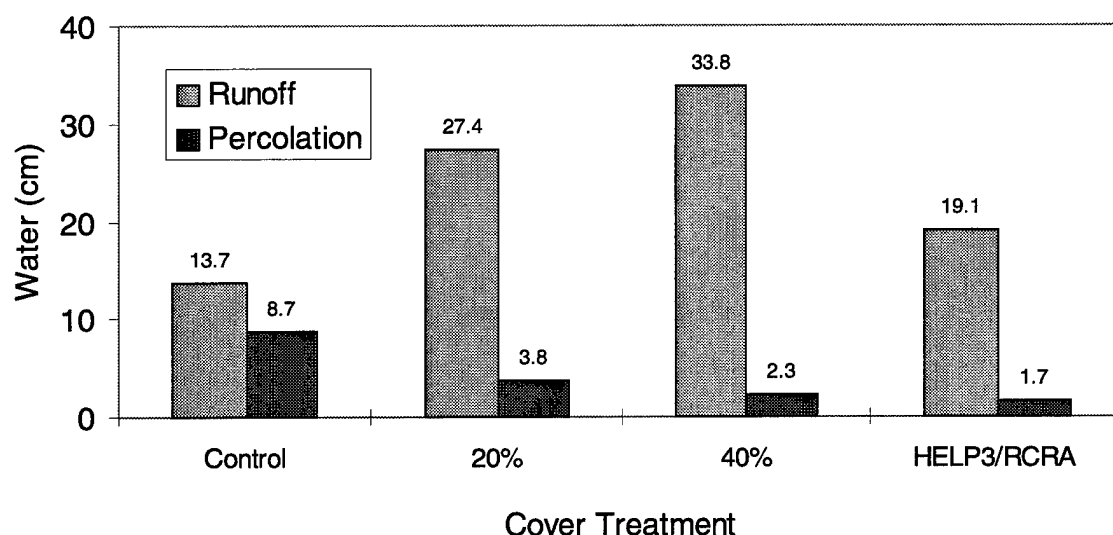


Figure 42. Comparative performance of MCBH cover designs and RCRA clay cap over a 21 month period.

Results also demonstrate that the hydrologic response of the MCBH cover designs was highly dependent on season and a related variable, the amount of precipitation falling during a particular month. Most of the runoff and percolation was generated during a few months in winter when most of the precipitation was measured. Furthermore, at least 75%-98% of the runoff and percolation was generated during the 4 months when precipitation exceeded 10 cm. Most months receiving less than 10 cm of precipitation contributed only minor amounts to the total runoff and percolation measured during the study.

Linear regression analysis indicated that runoff or percolation was not generated until a threshold monthly precipitation of 2-5 cm was exceeded. The relative amount of runoff or percolation from the field plots was significantly related to monthly precipitation. In contrast, HELP3.0b predicted runoff and percolation was either not related or weakly related to measured precipitation. Better correspondence of predicted data to precipitation was obtained when synthetic precipitation was used in the regressions.

Based upon a comparison of the predicted hydrologic performance of a modified RCRA clay cover and the two IC designs, these results show that the 40% IC design was approximately equal to the RCRA design and the 20% IC design was approximately within a factor of 2 of the RCRA design in their ability to limit percolation. While the IC designs rely on limiting infiltration, the RCRA design relies on lateral diversion of soil moisture in a drainage layer to prevent percolation. Based on the HELP3.0b simulation of the RCRA design, about 15% of the precipitation was predicted as lateral flow from the drainage layer.

The performance characteristics of the IC designs, as observed in the MCBH study, offer a simple and inexpensive alternative for interim stabilization or final closure of landfills in humid sites. The IC cover technology is simple in design, easy to install over an existing landfill cover, and easy to remove if other uses for the land emerge in the future.

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APPENDIX A. Geotechnical And Hydraulic Properties Of Soil Used To Construct MCBH Landfill Cover Demonstration Plots

1. Summary of Initial Moisture Content, Dry Bulk Density, and Calculated Porosity

Sample Number	Initial Moisture Content		Dry Bulk Density (g/cm ³)	Calculated Porosity (%)
	Gravimetric (%, cm ³ /cm ³)	Volumetric (%, cm ³ /cm ³)		
EES-15-A	19.6	26.9	1.37	48.3
EES-15-B	17.9	25.8	1.44	45.7

2. Summary Of Saturated Hydraulic Conductivity Tests

Sample Number	Method of Analysis		
	K _{sat} (cm/sec)	Constant Head	Falling Head
EES-15-A	5.4 x 10 ⁻⁷		X
EES-15-B	4.9 x 10 ⁻⁷		X

3. Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm ³ /cm ³)
EES-15-A	0	50.7
	56	49.4
	110	48.3
	510	40.6
	1020	38.5
	5099	35.6
	15501	31.8
EES-15-B	0	51.9
	56	50.7
	110	49.8
	510	42.2
	1020	40.1
	5099	37.8
	15501	34.2

4. Particle Size Characteristics

Sample Number	d ₁₀ (mm)	d ₅₀ (mm)	D ₉₀ (mm)	C _u	C _c	Wet Sieve	Hydrometer
EES-15-A	*	0.027	0.056	--	--	X	X
EES-15-B	*	0.033	0.069	--	--	X	X

* d₁₀ not reached with test specified

-- value dependent upon d₁₀

d₅₀ = median particle diameter

C_u = d₆₀/d₁₀

C_c = (d₃₀)²/(d₁₀) (d₆₀)

APPENDIX B. Construction Plan (In U.S. Customary Units)

Site Preparation

1. Rough level an area for the test plots of at least 140 x 50 ft.
2. Remove a 2 ft. layer over the entire pad area and stockpile for later use as cover soil material. Place the stockpile on either end of the 150 ft. dimension of the pad area as later backfilling of the plots will require entry from the sides of the plot area rather than the ends. It is important that the floor of this excavation have a 4% slope towards the ocean in order to facilitate leachate and runoff collection. This means that the drop over the 30 ft. axis of the plot will be 1'3".
3. Survey in four permanent locator posts at the extreme periphery of each corner of the pad area for later use in positioning profile components of the respective cap designs. Measurements will be taken from the four permanent locator posts to each cover plot to facilitate positioning of monitoring equipment directly above components that are hidden from view by backfill soil.
4. Survey in locations of each 19.7 x 29.5 ft. (6 x 9 m) cover plot.
5. Survey in leachate collection area in each plot. The collection area will be 10 x 27 ft. in size. The 27 ft. dimension will begin at the exact up slope end of the plot and end 1m short of the extreme downslope end. The 3 ft. gap on the downslope end is to minimize the influence of the downslope end plate (which acts as a cut off wall to laterally flowing water) on the accuracy of the leachate measurements.
6. Install a cutoff wall across the entire upper end of the pad area (should be about 150 ft. in width) in order to intercept both surface runoff and subsurface flow from upslope areas from entering the plot area. Excavate a trench 4 in. wide to an additional 2 ft. depth (2 ft. were already removed during the initial excavation) across the entire upslope end (~150 ft.) of the pad area. Use 4 x 8 ft. marine plywood to form a perpendicular frame in the 4 inch trench. The plywood will be placed with the 4 ft. dimension in the vertical (i.e., in the trench) and the 8 ft. dimension in the horizontal. Thus, if the cut off wall is 160 ft., then 20 sheets of plywood will be needed to complete the wall. After the plywood is in place, drape the liner material over the upslope side of the wall to form an impermeable barrier to water flow toward the plot. Seal any seams with supplier recommended methods. Partially backfill the wall on the upslope side so that it will freely stand on its own.

Leachate Collection Area And Down Slope End Wall

1. Excavate each 10x27 ft. leachate collection area to a depth of 1 ft. Place excavated material on soil stockpile area. Note that the floor of the leachate collection area will have a 4% slope corresponding to the slope placed on the floor of the initial excavation.
2. Use boards, 2x12 in, to construct a frame in the leachate collection area excavation. Nail or bolt frame together. It is important that the frame is rigid enough to define an exact area. Additional bracing on the external periphery of the frame, such as support stakes, etc., should be used to hold the frame in the exact 10x27 ft. configuration. The exact 10x27 ft. dimension should be verified by measuring internal dimensions with a square.
3. Drape the liner material over the frame and fit it into the entire excavated area so that it is completely supported by the frame and/or underlying soil. Trim the excess liner on the sides, downslope, and upslope end of the leachate collection frame and fasten the trimmed edges on the outside of the wooden support frame with nails or screws.
4. Install the downslope endwall across the 19.7 ft. (6 m) width of the plot. First excavate a 2 ft. trench, like that done for the upslope cutoff wall, to provide a total depth from the finish plot surface of 4 ft. Use marine plywood, placed on its side edge, to form a 4 ft. high wall across the 20 ft. plot end. Partially backfill the outside (ocean side) of the wall to get it to stand freely. Fit a piece of angle iron on the lip of the plywood to serve as the control point for runoff leaving the plot. Make sure that the angle iron covered lip of the plywood is flush with the finished soil surface after the soil backfilling is completed.
5. Install the 4 in. drain pipe from the leachate collection area (cut a 4 in. hole in the 2 x 12 in. board and in the liner both near the very bottom of the leachate collection area floor to promote rapid drainage) through the end plate wall (cut a 4 in. hole to pass pipe through) to the location that the leachate flow monitoring system will be installed. Use 2 plates with compressible gaskets to seal the liner and 2 x 12 to the pipe as it passes through the leachate collection area. Leak test this connection to be sure that all leachate is delivered to the flow measuring system. Use silicon to seal the pipe to the end plate. A water tight seal at this joint is not necessary.
6. Fill the leachate collection area with gravel to promote free drainage. Use 3/4 - 1 in. diameter gravel, preferably uncrushed (smooth stones). After backfilling with gravel, the leachate collection area should be flush with the existing grade, the lower end plate wall in place, the upper cutoff wall in place, the plot border stakes in place, and the pad area locator stakes in place.
7. Measure from 4 pad corner locator stakes to all emplaced structures so that after backfilling these structures can be located from the measurement data.
8. Backfilling of the plots with soil can now begin.

Backfilling The Plots With Soil

1. Have a soil testing laboratory determine optimum moisture content of the soil for achieving optimum density during compaction. If soils are too dry, add water and mix with loader to try to bring the moisture content up to requirements.

2. Begin backfilling by pushing stockpiled soil on the sides of the pad area in front of loader onto all of the plot and interplot areas at the same time. Work from the plot nearest the stockpile toward plots further away from the stockpile by building a soil lift in front of the loader. Make the thickness of the initial soil lift thick enough to prevent damage from the loader to the leachate collection pan and drain pipe. Either use a light loader with a thinner soil lift (~10-12") or a thicker lift (~15") if the loader is heavy. Work this initial soil layer to a uniform depth over all of the plots. Compact this layer to 95% Proctor. While the lift thickness is greater than it should be to achieve the best compaction, we want to be sure not to damage the leachate collection system. Repeat this step, except that all subsequent lifts should be 6" and they should also be compacted to 95% Proctor. Test the degree of compaction of the soil on each lift every 25 ft² with a nuclear gauge. Areas that are 93% or less of optimum must be recompacted to achieve the 95% level. The total thickness of the soil profile after completion will be 2 ft.

Plot Borders

1. Install plot borders on the surface to define the runoff collection area on each plot. Center the borders over the leachate collection system using the pad locator stakes as a frame of reference. The plot borders can be fabricated from angle iron to form a sharp boundary for defining the surface area of the plot. The plot borders will enclose an area of 20 x 30 ft. and can either be welded or bolted together.

Water Harvesting System

1. Place 4 in. wide by 30 ft. long rain gutter at predetermined positions on the surface of each plot. Place end caps on each gutter and perforate the downslope end cap to allow free drainage of runoff from the gutter. The treatment involving a 20% increase in runoff generation requires 12 such gutters placed on 1'8" centers across the 20 ft. dimension of each plot. The treatments involving a 40% increase in runoff generation require 24 gutters placed on 10" centers. Fill each gutter with 3/4 " gravel.

APPENDIX C. Monitoring Equipment And Data Acquisition System

Runoff And Leachate Instrumentation: Runoff and leachate was separately collected in 120 liter barrels where 5 psi pressure transducers were used to measure depth of water in the barrels. Each barrel contained a 12 volt sump pump with level sensors and a 12 volt battery power supply. Several 18 watt solar panels were used to charge sump pump batteries. The pressure transducers were connected to Campbell AM416 multiplexers that were connected to a 21X data logger for control and data acquisition.

Water pumped from each barrel was channeled through a totalizing flow meter. The totalizers were connected in groups of six to one of the two Campbell SDMINTB interval timers. Each interval timer was controlled and logged by the 21X that was powered by a 12 volt deep cycle battery charged by an 18 watt solar panel. This 21X was connected to the telephone net by an MD9 multidrop interface.

Soil Moisture Monitoring System: Every plot had 4 Time Domain Reflectrometer (TDR) three prong probes installed at points that were 3 m from the short side of the plot and 2.5 m from the long side of the plot. The TDR rod pairs from every 2 plots (8 pairs) were connected to a SDM-X50 multiplexer set between the plots. These multiplexers were connected to another SDMX50 multiplexer that has been connected to a Tektronix 1502B that is controlled by a 21X Campbell Scientific data logger. The system records TDR wave length data. This data logger will be connected to a telephone net by an MD9 multidrop interface. The TDR system will be powered by a deep cycle 12 volt battery that is charged by a Campbell 18 watt solar panel.

Climatological Monitoring: A Campbell meteorology station measuring air temperature, relative humidity, wind speed, and wind direction will be controlled and data recorded by another 21X data logger. This 21X data logger will also be linked to the telephone net by another MD9 multidrop interface. Power will be supplied by a deep cycle 12 volt battery that is charged by the same solar panel that is being used by the TDR system.

Telephone Link: A cellular phone with an external antenna was connected to the DC1 12 modem. The modem was connected to the MD9 multidrop interface that was linked to the three other MD9 multidrop interfaces that are a part of the 21X data loggers. This system was powered by another 12 volt deep cycle battery that is charged by a Campbell 18 watt solar panel. No other equipment was connected to this power source.

APPENDIX D. Form to record point frame measurements for canopy and ground cover

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APPENDIX E. Species Composition On MCBH Plots In June 1996

TAXON NAME	COMMON NAME	STATUS*	40% A	20% A	Control A	40% B	20% B	Control B
MONOCOTS								
<i>Poaceae</i>								
<i>Brachiaria subquadrifida</i> (Trin.) Hitchc.		nat			Just outside			
<i>Cenchrus ciliaris</i> L.	Buffelgrass	nat	x	x	x	x	x	x
<i>Chloris barbata</i> (L.) Sw.	Swollen fingergrass	nat	x		x		x	x
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	nat			Just outside			
<i>Panicum maximum</i> Jacq.	Guinea grass	nat	x	x	x	x	x	x
<i>Panicum repens</i> L.	Torpedo or quack grass	nat	x	x	x	x	x	x
DICOTS								
<i>Asteraceae</i>								
<i>Bidens pilosa</i> L.	Spanish needle	nat	x	x	x	x	x	x
<i>Sonchus oleraceus</i> L.	Sow thistle	nat			x			
<i>Xanthium strumarium</i> L.	Cocklebur	nat				x		
<i>Euphorbiaceae</i>								
<i>Chamaesyce hirta</i> (L.) Millsp.	Hairy or garden spurge	nat			x		x	
<i>Fabaceae</i>								
<i>Acacia farnesiana</i> (L.) Willd.	Klu	nat				x		x
<i>Chamaecrista nictitans</i> (L.) Moench	Partridge pea	nat	x	x	x	x	x	x
<i>Crotalaria incana</i> L.	Fuzzy rattlepod	nat				x		
<i>Crotalaria verrucosa</i> L.	blue-flowered rattlepod	nat	x	x	x	x	x	x
<i>Desmanthus virgatus</i> (L.) Willd.	Slender or virgate imosa	nat	x	x	x	x	x	x
<i>Indigofera spicata</i> Forssk.	Creeping indigo	nat	x	x	x	x	x	x
<i>Indigofera suffruticosa</i> Mill.	Indigo	nat		x		x	x	
<i>Leucaena leucocephala</i> (Lam.) de Wit	Koa haole	nat		x		x	x	x
<i>Malvaceae</i>								
<i>Abutilon grandifolium</i> (Willd.) Sweet	Hairy abutilon	nat				x		
<i>Sterculiaceae</i>								
<i>Waltheria indica</i> L.	'Uhaloa	ind			Just outside			
<i>Verbenaceae</i>								
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaica vervain	nat		x		x	x	x

nat = introduced and naturalized,

ind = indigenous

APPENDIX F. Species Composition On MCBH Plots In March 1997

TAXON NAME	COMMON NAME	STATUS*	40% A	20% A	Control A	40% B	20% B	Control B1'
MONOCOTS								
<i>Poaceae</i>								
<i>Cenchrus ciliaris</i> L.	Buffelgrass	nat	x	x	x	x	x	x
<i>Chloris barbata</i> (L.) Sw.	Swollen fingergrass	nat	x	0	x	0	x	x
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	nat			0		0	
<i>Digitaria ciliates</i> (Retz.) Koeler	Henry's crabgrass	nat			0			
<i>Panicum maximum</i> Jacq.	Guinea grass	nat	x	x	x	x	x	x
<i>P. maximum</i> var. <i>trichogium</i> Eyles ex Robyns	Small guinea grass	nat	0	0	0	0	0	0
<i>Panicum repens</i> L.	Torpedo/quack grass	nat	x	x	x	x	M	x
<i>Cyperaceae</i>								
<i>Cyperus rotundus</i> L.	Nut grass	nat		0	0	0	0	0
DICOTS								
<i>Asteraceae</i>								
<i>Bidens pilosa</i> L.	Spanish needle	nat	x	x	x	x	x	x
<i>Emelia fosbergii</i> Nicolson	Flora's paintbrush	nat		0		0	0	0
<i>Sonchus oleraceus</i> L.	Sow thistle	nat	0	0	x	0	0	0
<i>Tridax procumbens</i> L.	Coat buttons	nat			0			
<i>Xanthium strumarium</i> L.	Cocklebur	nat		0		x	0	0
<i>Convolvulaceae</i>								
<i>Merremia aegyptia</i> (L.) Urb.	Hairy merremia	nat?				0		
<i>Euphorbiaceae</i>								
<i>Chamaesyce hirta</i> (L.) Milisp.	Hairy/garden spurge	nat		0	x	0	x	0
<i>Fabaceae</i>								
<i>Acacia farnesiana</i> (L.) Willd.	Klu	nat				x		x
<i>Chamaecrista nictitans</i> (L.) Moench	Partridge pea	nat	x	x	x	x	x	x
<i>Crotalaria incana</i> L.	Fuzzy rattlepod	nat				M		
<i>Crotalaria verrucosa</i> L.	blue4lowered rattlepod	nat	x	x	x	x	x	x
<i>Desmanthus virgatus</i> (L.) Willd.	Slender mimosa	nat	x	x	x	x	x	x
<i>Indigofera spicata</i> Forssk.	Creeping indigo	nat	x	x	x	x	x	x
<i>Indigofera suffruticosa</i> Mill.	Indigo	nat		x	0	x	x	x
<i>Leucaena leucocephala</i> (Lam.) de Wit	Koa haole	nat		x		x	x	x
<i>Malvaceae</i>								
<i>Abutilon grandifolium</i> (Willd.) Sweet	Hairy abutilon	nat				x		
<i>Sida rhombifolia</i> L.		nat?						0
<i>Sterculiaceae</i>								
<i>Waltheria indica</i> L.	'Uhaloa	ind						0
<i>Verbenaceae</i>								
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaica vervain	nat		x		x	x	x

nat = introduced and naturalized, ind= indigenous
x = present in plot in 1996 and 1997, 0= new in plot in 1997
M = missing from plot in 1997 but present in 1996

APPENDIX G. Mean Relative Canopy and Ground Cover (%) as a Function of Time and Cover Treatment on MCBH Landfill Cover Demonstration Plots

ET Soil Cover		Mar-95	May-95	Jul-95	Feb-96	Jun-96	Sep-96	Jan-97	Jun-97
Canopy	Grass	53.4	43.3	25.8	41.6	36.7	35.2	78.0	56.6
	Shrub	0.0	0.8	0.7	3.7	6.4	0.3	2.5	1.4
	Forb	4.4	5.8	2.3	23.1	10.4	8.7	10.7	9.7
	Std Dead	20.8	43.8	51.9	21.0	32.9	27.0	4.9	16.0
	Zero	22.8	2.8	15.4	8.0	13.6	28.9	3.9	16.4
Ground	Gutter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Litter	5.1	95.8	98.7	100.0	100.0	100.0	100.0	100.0
	Bare Soil	94.9	4.2	1.3	0.0	0.0	0.0	0.0	0.0
20% IC									
Canopy	Grass	60.9	58.6	26.6	41.2	37.5	37.1	73.0	55.1
	Shrub	0.0	0.3	0.0	1.9	7.4	0.4	6.3	3.4
	Forb	2.5	3.9	1.8	23.4	10.7	7.5	9.2	8.4
	Std Dead	11.4	32.2	59.9	25.3	35.6	36.2	8.0	22.1
	Zero	25.2	4.9	10.6	7.2	8.9	18.8	3.5	11.1
Ground	Gutter	24.1	22.6	23.5	24.3	23.9	23.7	22.5	23.1
	Litter	41.6	75.8	76.0	75.7	76.1	76.3	77.5	76.9
	Bare Soil	34.3	1.6	0.5	0.0	0.0	0.0	0.0	0.0
40% IC									
Canopy	Grass	41.3	44.7	24.4	39.3	33.8	32.1	61.6	46.9
	Shrub	0.0	1.2	0.0	2.1	6.6	2.7	6.1	4.4
	Forb	5.2	4.2	2.1	13.5	7.5	4.4	11.4	7.9
	Std Dead	46.7	37.6	46.7	22.5	34.3	31.6	9.3	20.5
	Zero	12.0	12.3	25.7	22.6	17.9	29.1	11.7	20.4
Ground	Gutter	46.4	44.2	44.3	44.8	44.7	46.6	46.3	46.4
	Litter	3.0	54.6	55.7	55.2	55.3	53.4	53.7	53.6
	Bare Soil	50.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0

**APPENDIX H. Percent Species Composition of Vegetation (# point frame hits/ 640 x 100)
on MCBH Plots as a Function of Time. Key to Plant Species Abbreviations in the Tables
Appear at the End of This Appendix**

MARCH-1995					
SPECIES	Soil A	Soil B	MEAN	SD	CV
Pare	53.8	41.5	47.6	8.7	18.3
Chba	0.0	3.3	1.6	2.3	141.4
Ceci	0.5	0.0	0.2	0.3	141.4
Cyda	0.5	7.2	3.9	4.8	123.4
FORB	1.1	4.4	2.8	2.3	83.2
STD. DEAD	35.7	20.8	28.3	10.5	37.3
ZERO	8.4	22.8	15.6	10.2	65.5
GUTTER	0.0	0.0	0.0	0.0	
LITTER	4.8	5.1	4.9	0.2	4.7
BARE SOIL	95.2	94.9	95.1	0.2	0.2
SPECIES	20A	20B	MEAN	SD	CV
PR	55.6	54.9	55.2	0.5	0.8
Chba	6.4	0.3	3.4	4.3	127.6
Ceci	0.2	0.0	0.1	0.1	141.4
Cyda	0.0	4.4	2.2	3.1	141.4
FORB	3.8	1.3	2.5	1.7	68.4
STD. DEAD	3.4	19.3	11.4	11.2	98.7
ZERO	30.7	19.7	25.2	7.8	30.9
GUTTER	23.9	24.3	24.1	0.2	1.0
LITTER	7.5	75.7	41.6	48.2	115.8
BARE SOIL	68.5	0.0	34.3	48.5	141.4
	40A	40B	MEAN	SD	CV
Pare	41.3	41.3	41.3	0.0	0.0
Chba	0.0	0.0	0.0	0.0	
Ceci	0.0	0.0	0.0	0.0	
Cyda	0.0	0.0	0.0	0.0	
Forb	0.0	10.3	5.2	7.3	141.4
STD. DEAD	46.7	46.7	46.7	0.0	0.0
ZERO	12.0	12.0	12.0	0.0	0.0
GUTTER	47.4	45.4	46.4	1.4	3.0
LITTER	5.9	0.2	3.0	4.1	133.8
BARE SOIL	46.7	54.4	50.6	5.4	10.8
MAY-1995					
VEG TYPE	SOIL A	SOIL B	MEAN	SD	CV
Pare	48.5	31.0	39.8	12.4	31.2
Chba	0.0	2.6	1.3	1.9	141.4
Cyda	0.0	0.0	0.0	0.0	
Pama	2.6	1.8	2.2	0.6	26.2
Acfa	0.7	0.3	0.5	0.2	47.1
Insu	0.0	0.2	0.1	0.1	141.4

Stja	0.0	0.5	0.2	0.3	141.4
Crve	1.6	5.6	3.6	2.8	77.1
Bipi	0.0	1.1	0.6	0.8	141.4
Insp	0.0	3.3	1.6	2.3	141.4
STD. DEAD	41.0	46.6	43.8	3.9	9.0
ZERO	5.6	0.0	2.8	3.9	141.4
GUTTER	0.0	0.0	0.0	0.0	
LITTER	98.5	93.1	95.8	3.8	4.0
BARE SOIL	1.5	6.9	4.2	3.8	91.5
SPECIES	20A	20B	MEAN	SD	CV
Pare	59.0	52.0	55.5	5.0	9.0
Chba	4.1	1.0	2.5	2.2	86.7
Cyda	0.7	0.0	0.3	0.5	141.4
Pama	0.5	0.0	0.2	0.3	141.4
Acfa	0.7	0.0	0.3	0.5	141.4
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.0	0.0	0.0	
Crve	2.5	1.5	2.0	0.7	35.4
Bipi	0.8	2.1	1.5	0.9	62.9
Insp	0.2	0.8	0.5	0.5	94.3
STD. DEAD	26.2	38.2	32.2	8.5	26.3
ZERO	5.4	4.4	4.9	0.7	14.1
GUTTER	23.1	22.1	22.6	0.7	3.1
LITTER	73.9	77.7	75.8	2.7	3.5
BARE SOIL	3.0	0.2	1.6	2.0	126.5
SPECIES	40A	40B	MEAN	SD	CV
Pare	46.6	40.2	43.4	4.5	10.4
Chba	0.7	2.0	1.3	0.9	70.7
Cyda	0.0	0.0	0.0	0.0	
Pama	0.0	0.0	0.0	0.0	
Acfa	0.0	2.5	1.2	1.7	141.4
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.0	0.0	0.0	
Crve	0.0	6.2	3.1	4.4	141.4
Bipi	0.0	0.7	0.3	0.5	141.4
Insp	0.0	1.5	0.7	1.0	141.4
STD. DEAD	36.2	39.0	37.6	2.0	5.2
ZERO	16.6	8.0	12.3	6.0	49.0
GUTTER	43.3	45.1	44.2	1.3	2.9
LITTER	55.1	54.1	54.6	0.7	1.3
BARE SOIL	1.6	0.8	1.2	0.6	47.1

JULY-1995					
SPECIES	SOIL A	SOIL B	MEAN	SD	CV
PC	34.1	17.5	25.8	11.7	45.3
Chba	0.0	0.0	0.0	0.0	
Cyda	0.0	0.0	0.0	0.0	
Pama	0.0	0.0	0.0	0.0	
Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
Stja	1.3	0.0	0.7	0.9	141.4
Crve	1.8	2.8	2.3	0.7	30.3
Bipi	0.0	0.0	0.0	0.0	
Insp	0.0	0.0	0.0	0.0	
STD. DEAD	44.3	59.5	51.9	10.8	20.8
ZERO	18.5	12.3	15.4	4.4	28.6
GUTTER	0.0	0.0	0.0	0.0	
LITTER	99.8	97.5	98.7	1.6	1.6
BARE SOIL	0.2	2.5	1.3	1.6	123.7
SPECIES	20A	20B	MEAN	SD	CV
Pare	28.4	24.8	26.6	2.6	9.6
Chba	0.0	0.0	0.0	0.0	
Cyda	0.0	0.0	0.0	0.0	
Pama	0.0	0.0	0.0	0.0	
Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.0	0.0	0.0	
Crve	1.3	2.3	1.8	0.7	38.6
Bipi	0.0	0.0	0.0	0.0	
Insp	0.0	0.0	0.0	0.0	
STD. DEAD	55.7	64.1	59.9	5.9	9.9
ZERO	13.8	7.4	10.6	4.5	42.8
GUTTER	23.4	23.6	23.5	0.1	0.5
LITTER	75.7	76.2	76.0	0.3	0.5
BARE SOIL	0.8	0.2	0.5	0.5	94.3
SPECIES	40A	40B	MEAN	SD	CV
Pare	29.7	19.2	24.4	7.4	30.4
Chba	0.0	0.0	0.0	0.0	
Cyda	0.0	0.0	0.0	0.0	
Pama	0.0	0.0	0.0	0.0	
Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.0	0.0	0.0	
Crve	0.0	4.3	2.1	3.0	141.4
Bipi	0.0	0.0	0.0	0.0	
Insp	0.0	0.0	0.0	0.0	
STD. DEAD	35.2	58.2	46.7	16.2	34.7

ZERO	35.1	16.2	25.7	13.3	52.0
GUTTER	44.9	43.8	44.3	0.8	1.8
LITTER	55.1	56.2	55.7	0.8	1.5
BARE SOIL	0.0	0.0	0.0	0.0	

FEBRUARY-1996

SPECIES	SOIL A	SOIL B	MEAN	SD	CV
Pare	44.8	17.9	31.3	19.0	60.7
Chba	0.5	4.6	2.5	2.9	114.0
Cyda	0.0	0.0	0.0	0.0	
Pama	7.0	8.4	7.7	0.9	12.0
Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
lele	2.8	3.4	3.1	0.5	14.9
Stja	0.0	1.1	0.6	0.8	141.4
Crve	10.3	21.6	16.0	8.0	50.0
Bipi	1.5	12.8	7.1	8.0	112.2
Insp	0.0	0.0	0.0	0.0	
STD. DEAD	22.3	19.7	21.0	1.9	8.8
ZERO	10.8	5.2	8.0	3.9	49.1
GUTTER	0.0	0.0	0.0	0.0	
LITTER	100.0	100.0	100.0	0.0	0.0
BARE SOIL	0.0	0.0	0.0	0.0	
SPECIES	20A	20B	MEAN	SD	CV
Pare	51.3	17.5	34.4	23.9	69.4
Chba	0.7	0.5	0.6	0.1	20.2
Cyda	0.0	0.0	0.0	0.0	
Pama	4.9	7.4	6.1	1.7	28.3
Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
lele	2.0	1.8	1.9	0.1	6.1
Stja	0.0	0.0	0.0	0.0	
Crve	0.0	21.6	10.8	15.3	141.4
Bipi	16.1	8.9	12.5	5.1	40.9
Insp	0.0	0.2	0.1	0.1	141.4
STD. DEAD	16.2	34.4	25.3	12.9	50.8
ZERO	8.9	5.6	7.2	2.3	32.1
GUTTER	24.4	24.3	24.3	0.1	0.5
LITTER	75.6	75.7	75.7	0.1	0.2
BARE SOIL	0.0	0.0	0.0	0.0	0.0
SPECIES	40A	40B	MEAN	SD	CV
Pare	39.2	26.2	32.7	9.2	28.0
Chba	1.1	1.6	1.4	0.3	25.0
Cyda	0.0	0.0	0.0	0.0	
Pama	1.0	9.5	5.2	6.0	114.9

Acfa	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
Lele	0.2	3.9	2.0	2.7	130.1
Stja	0.0	0.0	0.0	0.0	
Crve	2.1	15.6	8.9	9.5	107.4
Bipi	1.3	8.0	4.7	4.8	101.7
Insp	0.0	0.0	0.0	0.0	
STD. DEAD	22.3	22.6	22.5	0.2	1.0
ZERO	32.8	12.5	22.6	14.4	63.5
GUTTER	44.3	45.4	44.8	0.8	1.8
LITTER	55.7	54.6	55.2	0.8	1.5
BARE SOIL	0.0	0.0	0.0	0.0	

JUNE-1996

VEG TYPE	SOIL A	SOIL B	MEAN	CV
GRASS	42.5	31.0	36.7	22.1
SHRUB	6.4	6.4	6.4	0.0
FORB	7.5	13.3	10.4	39.0
STD. DEAD	23.6	42.1	32.9	39.9
GUTTER	0.0	0.0	0.0	
LITTER	100.0	100.0	100.0	0.0
ZERO	20.0	7.2	13.6	66.5
BARE SOIL	0.0	0.0	0.0	

VEG TYPE	20A	20B	MEAN	CV
GRASS	52.6	22.3	37.5	57.2
SHRUB	7.0	7.7	7.4	6.3
FORB	9.8	11.6	10.7	11.9
STD. DEAD	21.8	49.3	35.6	54.7
GUTTER	8.7	9.0	8.9	2.6
LITTER	24.9	23.0	23.9	5.8
ZERO	75.1	77.0	76.1	1.8
BARE SOIL	0.0	0.0	0.0	

VEG TYPE	40A	40B	MEAN	CV
GRASS	36.2	31.3	33.8	10.3
SHRUB	0.0	13.1	6.6	141.4
FORB	5.1	9.8	7.5	45.1
STD. DEAD	37.0	31.6	34.3	11.1
GUTTER	21.6	14.1	17.9	29.8
LITTER	44.4	44.9	44.7	0.8
ZERO	55.6	55.1	55.3	0.6
BARE SOIL	0.0	0.0	0.0	

SEPTEMBER-1996					
SPECIES	SOIL A	SOIL B	MEAN	SD	CV
Pare	34.3	6.2	20.2	19.8	97.9
Pama	1.8	8.7	5.2	4.9	92.8
Chba	0.5	4.3	2.4	2.7	112.2
Ceci	2.5	12.1	7.3	6.8	93.8
Lele	0.0	0.0	0.0	0.0	
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.5	0.2	0.3	141.4
Acfa	0.0	0.0	0.0	0.0	
Devi	2.6	1.5	2.0	0.8	39.6
Insp	0.7	5.2	3.0	3.2	110.0
Chni	2.0	1.8	1.9	0.1	6.1
Crve	1.1	0.8	1.0	0.2	23.6
Xast	0.0	0.0	0.0	0.0	
Bipi	0.0	1.0	0.5	0.7	141.4
Abgr	0.0	0.2	0.1	0.1	141.4
Crin	0.0	0.5	0.2	0.3	141.4
Wain	0.0	0.0	0.0	0.0	
STD. DEAD	21.1	33.0	27.0	8.3	30.9
ZERO	33.4	24.3	28.9	6.5	22.5
GUTTER	0.0	0.0	0.0	0.0	
LITTER	100.0	100.0	100.0	0.0	0.0
SPECIES	20A	20B	MEAN	SD	CV
Pare	43.1	12.0	27.5	22.0	80.0
Pama	3.9	6.1	5.0	1.5	30.1
Chba	0.5	1.0	0.7	0.3	47.1
Ceci	1.5	6.2	3.9	3.4	87.3
Lele	0.2	0.0	0.1	0.1	141.4
Insu	0.3	0.3	0.3	0.0	0.0
Stja	0.0	0.0	0.0	0.0	
Acfa	0.0	0.0	0.0	0.0	
Devi	1.6	5.4	3.5	2.7	75.6
Insp	0.7	3.6	2.1	2.1	97.9
Chni	0.7	1.5	1.1	0.6	54.4
Crve	0.2	0.3	0.2	0.1	47.1
Xast	0.0	0.0	0.0	0.0	
Bipi	0.0	0.0	0.0	0.0	
Abgr	0.0	0.5	0.2	0.3	141.4
Crin	0.0	0.5	0.2	0.3	141.4
Wain	0.0	0.0	0.0	0.0	
STD. DEAD	29.0	43.4	36.2	10.2	28.2
ZERO	18.4	19.2	18.8	0.6	3.1

LITTER	76.7	75.9	76.3	0.6	0.8
GUTTER	23.3	24.1	23.7	0.6	2.4
SPECIES	40A	40B	MEAN	SD	CV
Pare	22.1	26.4	24.3	3.0	12.4
Pama	0.0	9.7	4.8	6.8	141.4
Chba	2.3	0.2	1.2	1.5	122.6
Ceci	3.3	0.3	1.8	2.1	115.7
Lele	0.0	3.0	1.5	2.1	141.4
Insu	0.0	0.0	0.0	0.0	
Stja	0.0	0.0	0.0	0.0	
Acfa	0.0	2.5	1.2	1.7	141.4
Devi	0.3	1.3	0.8	0.7	84.9
Insp	1.5	1.5	1.5	0.0	0.0
Chni	0.0	1.3	0.7	0.9	141.4
Crve	1.3	0.0	0.7	0.9	141.4
Xast	0.2	0.0	0.1	0.1	141.4
Bipi	1.1	0.2	0.7	0.7	106.1
Abgr	0.0	0.2	0.1	0.1	141.4
Crin	0.0	0.0	0.0	0.0	
Wain	0.0	0.0	0.0	0.0	
STD. DEAD	35.6	27.7	31.6	5.6	17.6
ZERO	32.3	25.9	29.1	4.5	15.5
LITTER	53.0	53.9	53.4	0.7	1.3
GUTTER	47.0	46.1	46.6	0.7	1.5

JANUARY-1997

SPECIES	CONTRA	CONTRB	MEAN	SD	CV
Chba	1.3	16.7	9.0	10.9	120.9
Pare	59.0	26.2	42.6	23.2	54.4
Ceci	10.3	24.3	17.3	9.9	57.0
Pama	3.0	13.1	8.0	7.2	89.5
Cyda	0.0	2.0	1.0	1.4	141.4
Devi	0.3	0.0	0.2	0.2	141.4
Stja	0.0	2.0	1.0	1.4	141.4
Lele	0.0	0.3	0.2	0.2	141.4
Acfa	1.1	1.1	1.1	0.0	0.0
Insu	0.2	0.0	0.1	0.1	141.4
Xast	0.0	0.2	0.1	0.1	141.4
Insp	0.8	0.3	0.6	0.3	60.6
Crve	7.0	2.0	4.5	3.6	79.7
Bipi	1.1	1.6	1.4	0.3	25.0
Abgr	0.0	0.0	0.0	0.0	
Crin	0.2	0.0	0.1	0.1	141.4
Wain	0.0	0.5	0.2	0.3	141.4
Chni	3.4	1.5	2.5	1.4	56.6

Sool	2.1	0.0	1.1	1.5	141.4
Chhi	0.0	0.5	0.2	0.3	141.4
STD. DEAD	5.1	4.8	4.9	0.2	4.7
ZERO	4.9	3.0	3.9	1.4	35.4
LITTER	100.0	100.0	100.0	0.0	0.0
GUTTER	0.0	0.0	0.0	0.0	
SPECIES	20A	20B	MEAN	SD	CV
Chba	7.9	8.4	8.1	0.3	4.3
Pare	54.9	40.2	47.5	10.4	21.9
Ceci	7.5	11.3	9.4	2.7	28.3
Pama	5.9	7.0	6.5	0.8	12.5
Cyda	0.0	3.0	1.5	2.1	141.4
Devi	0.5	0.3	0.4	0.1	28.3
Stja	0.8	2.5	1.6	1.2	70.7
Lele	1.1	0.2	0.7	0.7	106.1
Acfa	3.0	1.8	2.4	0.8	34.1
Insu	2.0	0.5	1.2	1.0	84.9
Xast	0.0	0.0	0.0	0.0	
Insp	0.7	0.3	0.5	0.2	47.1
Crve	2.5	7.0	4.8	3.2	68.3
Bipi	0.2	2.6	1.4	1.7	124.8
Abgr	0.0	0.0	0.0	0.0	
Crin	0.2	0.0	0.1	0.1	141.4
Wain	0.0	0.0	0.0	0.0	
Chni	0.7	2.3	1.5	1.2	78.6
Sool	1.8	0.2	1.0	1.2	117.9
Chhi	0.0	0.0	0.0	0.0	
STD. DEAD	6.9	9.0	8.0	1.5	19.0
ZERO	3.6	3.4	3.5	0.1	3.3
LITTER	77.2	77.9	77.5	0.5	0.6
GUTTER	22.8	22.1	22.5	0.5	2.1
SPECIES	40A	40B	MEAN	SD	CV
Chba	11.8	7.4	9.6	3.1	32.6
Pare	45.6	32.3	38.9	9.4	24.1
Ceci	8.0	8.4	8.2	0.2	2.8
Pama	0.0	9.7	4.8	6.8	141.4
Cyda	0.0	0.0	0.0	0.0	
Devi	0.0	1.5	0.7	1.0	141.4
Stja	0.0	1.0	0.5	0.7	141.4
Lele	0.0	3.6	1.8	2.6	141.4
Acfa	0.0	2.6	1.3	1.9	141.4
Insu	0.0	3.4	1.7	2.4	141.4
Xast	0.0	0.3	0.2	0.2	141.4
Insp	1.3	1.5	1.4	0.1	8.3

Crve	7.0	4.9	6.0	1.5	25.2
Bipi	3.3	0.3	1.8	2.1	115.7
Abgr	0.2	0.5	0.3	0.2	70.7
Crin	0.3	0.0	0.2	0.2	141.4
Wain	0.0	0.0	0.0	0.0	
Chni	0.0	2.8	1.4	2.0	141.4
Sool	0.2	0.2	0.2	0.0	0.0
Chhi	0.0	0.0	0.0	0.0	
STD. DEAD	7.9	10.7	9.3	2.0	21.3
ZERO	14.4	9.0	11.7	3.8	32.6
LITTER	53.4	53.9	53.7	0.3	0.6
GUTTER	46.6	46.1	46.3	0.3	0.8

JUNE-1997

	SOIL A	SOIL B	MEAN	CV
GRASS	41.5	30.8	36.1	20.8
SHRUB	7.2	10.7	8.9	27.2
FORB	25.1	20.0	22.5	15.9
STD. DEAD	22.5	36.7	29.6	34.1
ZERO	3.8	1.8	2.8	49.9
GUTTER	0.0	0.0	0.0	
LITTER	100.0	100.0	100.0	0.0
BARE SOIL	0.0	0.0	0.0	
	20A	20B	MEAN	CV
GRASS	38.5	24.9	31.7	30.3
SHRUB	15.6	11.3	13.4	22.4
FORB	18.4	26.6	22.5	25.8
STD. DEAD	23.4	33.6	28.5	25.2
ZERO	4.1	3.6	3.9	9.0
GUTTER	22.8	21.6	22.2	3.7
LITTER	77.2	78.4	77.8	1.0
BARE SOIL	0.0	0.0	0.0	
	40A	40B	MEAN	CV
GRASS	29.5	26.2	27.9	8.3
SHRUB	2.3	24.9	13.6	117.6
FORB	14.9	17.9	16.4	12.7
STD. DEAD	36.4	24.4	30.4	27.8
ZERO	16.9	6.6	11.7	62.3
GUTTER	45.1	45.9	45.5	1.3
LITTER	54.9	54.1	54.5	1.1
BARE SOIL	0.0	0.0	0.0	

KEY TO PLANT SPECIES ABBREVIATIONS

GRASSES

PS= Pare= *Panicum repens*= #2
 PL= Pama= *PANICUM MAXIMUM*= #4
 cyda= crab grass=*Cyda*= *Cynodon dactylum*
 BU= Chba= *Chloris Barbata*
 Ceci= *CHENCHRUS CILIARIS*
 CR=Chba
 G5= Unidentified grass=cyda
 UGR=Pama

SHRUB

Devi= *DESMANTHUS VIRGATUS*
 Lele= *LEUCANA LEUCOCEPHALA*
 LE=Acfa
 SH= Stja= *STACHYTARPHETA JAMAICENSIS*
 LE1=Insu= *INDIGOFERA SUFFRUTICOSA*

FORB

CL= Insp
 CL1= Insp
 21-Chni= *CHAMAESYCE NICITANS*
 11-Xast= *XANTHIUM STRUMARIUM*
 19-Wain= *WALTHERIA INDICA*
 13-Crve= *CROTALARIA VERRUCOSA*
 30-Sool= *SONCHUS OLERACEUS*
 39-Chhi= *CHAMAESYCE HIRTA*
 17-Crin= *CROTALARIA INCANA*
 Chni= *CHAMAECRISTA NICOTANS*
 Abgr= *ABUTILON GRANDIFOLIUM*
 F= Forb=Crve= *CROTALARIA VERRUCOSA*
 F1=Bipi= *BIDENS PILOSA*

GROUND COVER

F2= Bipi
 SD= Standing Dead
 Zero= No hit
 G= Gutter
 BG= Bare ground
 L= Litter
 SD= Standing Dead
 G5= Unidentified grass=cyda
 G= Gutter
 BG= Bare ground
 L= Litter
 Zero= No hit

APPENDIX I. Measured and Predicted Monthly Precipitation (cm) at MCBH Landfill Cover Demonstration Site

	MEASURED¹	CLIGEN	30 YR. AVERAGE²
Nov-95	8.6	8.0	11.7
Dec-95	4.3	9.6	11.4
Jan-96	20.0	16.7	14.0
Feb-96	2.4	10.8	9.6
Mar-96	12.9	11.1	9.6
Apr-96	1.5	8.5	9.1
May-96	1.0	6.0	5.8
Jun-96	7.3	2.0	3.3
Jul-96	2.7	4.6	4.8
Aug-96	3.4	6.1	4.6
Sep-96	3.1	5.2	4.8
Oct-96	1.0	7.5	7.6
Nov-96	38.5	8.0	11.7
Dec-96	5.6	9.6	11.4
Jan-97	12.6	16.7	14.0
Feb-97	1.3	10.8	9.6
Mar-97	4.9	11.1	9.6
Apr-97	5.0	8.5	9.1
May-97	4.5	6.0	5.8
Jun-97	2.3	2.0	3.3
Jul-97	4.1	4.6	4.8
Aug-97	1.0	6.1	4.6
Sep-97	1.2	5.2	4.8
Oct-97	2.3	7.5	7.6
Nov-97	2.4	8.0	11.7
Dec-97	3.2	9.6	11.4
Jan-98	0.8	16.7	14.0
Feb-98	0.2	10.8	9.6
Mar-98	0.9	11.1	9.6
SUM	158.9	248.5	249.3

¹ Measured during study

² Measured by MCBH personnel

APPENDIX J. Measured And Predicted Monthly Runoff (cm) From MCBH Landfill Cover Demonstration Plots

	Soil A	Soil B	20% IC A	20% IC B	40% IC A	40% IC B	HELP3/ RCRA
Nov-95	0.00	0.02	0.09	0.09	0.00	0.30	0.63
Dec-95	0.00	0.00	0.19	0.14	0.27	0.62	0.90
Jan-96	2.61	4.92	5.20	7.12	6.33	7.39	1.76
Feb-96	0.00	0.00	0.00	0.00	0.19	0.08	0.41
Mar-96	1.77	2.69	3.19	4.10	3.25	5.01	0.60
Apr-96	0.00	0.00	0.00	0.00	0.00	0.00	0.24
May-96	0.00	0.00	0.00	0.00	0.00	0.00	1.15
Jun-96	0.54	0.00	0.04	0.00	0.04	0.00	0.00
Jul-96	0.01	0.00	0.00	0.01	0.04	0.08	0.01
Aug-96	0.00	0.00	0.00	0.00	0.09	0.10	0.05
Sep-96	0.00	0.00	0.00	0.11	0.05	0.10	0.02
Oct-96	0.00	0.00	0.00	0.00	0.00	0.00	1.66
Nov-96	3.18	5.77	7.88	12.89	8.12	14.23	0.63
Dec-96	0.05	0.08	0.00	0.49	0.34	0.50	0.90
Jan-97	1.53	2.31	2.16	5.18	4.12	6.68	1.76
Feb-97	0.00	0.00	0.01	0.00	0.00	0.00	0.41
Mar-97	0.48	0.44	1.07	1.27	1.86	1.35	0.60
Apr-97	0.14	0.20	0.44	0.42	1.33	0.46	0.24
May-97	0.16	0.39	0.77	0.86	1.50	1.09	1.15
Jun-97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul-97	0.00	0.00	0.00	0.10	0.20	0.09	0.01
Aug-97	0.00	0.00	0.00	0.01	0.00	0.00	0.05
Sep-97	0.00	0.00	0.00	0.02	0.00	0.00	0.02
Oct-97	0.00	0.00	0.00	0.01	0.41	0.29	1.66
Nov-97	0.00	0.12	0.00	0.07	0.13	0.31	0.63
Dec-97	0.00	0.00	0.17	0.37	0.13	0.15	0.90
Jan-98	0.00	0.07	0.09	0.18	0.13	0.16	1.76
Feb-98	0.00	0.00	0.00	0.00	0.00	0.00	0.41
Mar-98	0.00	0.00	0.00	0.00	0.00	0.00	
sum	10.47	17.02	21.28	33.43	28.56	39.00	18.54
Average	13.8		27.4		33.8		18.5

APPENDIX K. Plot Pair Average Runoff (cm) From MCBH Plots

	SOIL	20%	40%	HELP3/RCRA
Nov-95	0.01	0.09	0.15	0.63
Dec-95	0.00	0.16	0.44	0.90
Jan-96	3.77	6.16	6.86	1.76
Feb-96	0.00	0.00	0.14	0.41
Mar-96	2.23	3.65	4.13	0.60
Apr-96	0.00	0.00	0.00	0.24
May-96	0.00	0.00	0.00	1.15
Jun-96	0.27	0.02	0.02	0.00
Jul-96	0.00	0.01	0.06	0.01
Aug-96	0.00	0.00	0.10	0.05
Sep-96	0.00	0.06	0.07	0.02
Oct-96	0.00	0.00	0.00	1.66
Nov-96	4.48	10.38	11.17	0.63
Dec-96	0.07	0.24	0.42	0.90
Jan-97	1.92	3.67	5.40	1.76
Feb-97	0.00	0.00	0.00	0.41
Mar-97	0.46	1.17	1.61	0.60
Apr-97	0.17	0.43	0.90	0.24
May-97	0.27	0.81	1.29	1.15
Jun-97	0.00	0.00	0.00	0.00
Jul-97	0.00	0.05	0.15	0.01
Aug-97	0.00	0.00	0.00	0.05
Sep-97	0.00	0.01	0.00	0.02
Oct-97	0.00	0.01	0.35	1.66
Nov-97	0.06	0.04	0.22	0.63
Dec-97	0.00	0.27	0.14	0.90
Jan-98	0.03	0.13	0.15	1.76
Feb-98	0.00	0.00	0.00	0.41
Mar-98	0.00	0.00	0.00	0.60
SUM	13.74	27.35	33.78	19.14

APPENDIX L. Mean Relative Monthly Runoff (% of precipitation) From MCBH Plots

	SOIL	20% IC	40% IC	HELP/RCRA
Nov-95	0.1	1.0	1.7	7.9
Dec-95	0.0	3.8	10.5	9.4
Jan-96	18.8	30.8	34.3	10.6
Feb-96	0.0	0.0	5.6	3.8
Mar-96	17.3	28.3	32.0	5.4
Apr-96	0.0	0.0	0.0	2.8
May-96	0.0	0.0	0.0	19.1
Jun-96	3.7	0.2	0.3	0.0
Jul-96	0.2	0.2	2.4	0.2
Aug-96	0.0	0.0	2.9	0.8
Sep-96	0.1	1.8	2.4	0.3
Oct-96	0.0	0.0	0.0	22.2
Nov-96	11.6	27.0	29.0	7.9
Dec-96	1.2	4.3	7.5	9.4
Jan-97	15.2	29.1	42.8	10.6
Feb-97	0.1	0.3	0.0	3.8
Mar-97	9.4	23.9	32.8	5.4
Apr-97	3.4	8.6	17.9	2.8
May-97	6.1	18.3	29.0	19.1
Jun-97	0.0	0.0	0.0	0.0
Jul-97	0.0	1.3	3.6	0.2
Aug-97	0.0	0.4	0.0	0.8
Sep-97	0.0	0.7	0.0	0.3
Oct-97	0.0	0.3	15.5	22.2
Nov-97	2.4	1.5	9.0	7.9
Dec-97	0.0	8.3	4.4	9.4
Jan-98	4.5	17.3	18.8	10.6
Feb-98	0.0	0.0	0.1	3.8
Mar-98	0.0	0.0	0.0	5.4

APPENDIX M. Average soil moisture and standard deviation for each cover treatment plot at MCBH. Moisture represents cm of water in 0-15 cm of cover soil

	Soil A		Soil B		20% A		20% B		40% A		40% B	
	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD
07/19/96	10.8	6.0	10.9	4.5	9.0	1.7	10.7	4.3	9.0	1.5	8.4	3.7
07/20/96	10.0	4.3	10.6	4.4	10.4	3.8	11.3	5.3	8.4	1.4	8.0	4.0
07/21/96	10.0	4.3	7.5	6.6	10.9	4.0	11.0	5.4	8.0	1.2	8.0	4.3
07/22/96	9.6	3.8	9.8		10.3	3.8	9.9		8.3	1.3	8.1	3.8
07/23/96	10.4	5.2	10.5	4.3	10.6	4.0	12.1	5.6	8.5	1.5	8.0	3.9
07/24/96	9.7	3.8	7.2	6.3	10.4	3.7	10.6	5.5	7.9	1.3	7.8	4.0
07/26/96	9.3	3.6	10.3	0.3	10.6	3.8	9.8	0.4	7.7	1.8	7.8	4.2
07/29/96	10.5	5.3			10.1	4.0	10.2	0.9	7.1	1.8	7.6	4.3
07/30/96	9.7	4.1			10.4	4.0	9.5		7.9	1.4	7.4	4.1
08/01/96	8.5	3.9		5.5	8.2	1.8	11.1	6.3	6.5	2.0	6.9	4.4
08/02/96	8.3	4.7		0.7	9.6	3.8	10.7		6.3	2.0	6.8	4.4
08/03/96	8.7	4.5		5.5	9.8	4.0	8.4	3.7	6.7	1.6	6.9	4.2
08/04/96	8.2	4.5		5.6	9.8	4.0	10.0	4.9	6.5	2.4	6.7	4.6
08/05/96	8.1	3.9		5.7	9.6	3.9	8.7	4.0	5.9	2.3	6.9	4.5
08/06/96	7.6	4.1		0.1	9.6	4.1	8.6	0.5	6.4	2.4	6.4	4.6
08/07/96	8.0	3.6		5.7	9.4	4.0	9.4	5.3	6.4	1.9	6.4	4.6
08/08/96	8.2	3.6		5.5	9.6	4.3	7.7	3.1	5.8	2.6	6.6	4.7
08/09/96	7.5	4.0		5.4	7.8	1.6	8.2	3.6	5.8	2.4	6.5	4.6
08/10/96	7.6	3.1		5.8	7.7	1.8	7.4	3.3	4.9	3.2	6.4	4.6
08/13/96	7.6	3.8		0.7	9.2	4.1	9.7		12.4	5.7	8.6	3.3
08/14/96	7.1	4.1		5.9	9.3	4.0	9.2	5.1	11.2	6.1	8.7	3.4
08/15/96	7.7	3.0		5.2	9.3	4.0	10.5	6.2	10.5	5.4	6.1	4.5
08/26/96	6.6	3.7		5.6	7.4	1.6	9.0	4.6	5.2	2.4	5.8	5.0
08/27/96	6.9	3.6		5.8	9.1	4.2	6.9	2.7	5.3	2.4	6.1	5.1
08/29/96	6.4	3.9		5.5	7.5	1.7	7.2	3.1	5.1	2.5	6.3	4.9

08/30/96	7.0	4.0		5.1	8.8	4.2	8.5	5.0	4.8	2.8	5.8	5.0
08/31/96	12.3	5.5		5.6	8.9	4.4	10.9	2.7	11.8	5.2	8.7	2.0
09/01/96	16.5	3.4		6.1	12.3	4.2	14.4	2.2	11.9	5.5	12.3	2.5
09/02/96	16.2	3.5		5.9	12.1	4.2	14.1	2.4	12.0	5.3	12.2	2.9
09/03/96	15.7	3.3		5.6	11.8	4.1	14.0	2.5	11.2	5.0	12.0	2.9
09/04/96	15.8	3.4		5.5	12.0	3.6	13.9	2.2	10.9	4.6	11.7	2.8
09/05/96	16.0	3.0		5.1	11.8	3.8	14.4	2.4	12.8	5.4	12.2	2.5
09/06/96	15.2	2.9		5.8	11.9	3.8	14.0	2.6	12.3	5.2	12.0	2.7
09/08/96	15.7	2.8		5.2	13.2	3.1	14.1	2.2	12.0	5.7	12.5	2.5
09/10/96	15.1	3.2		5.0	13.3	3.2	13.8	2.3	10.7	5.3	11.5	3.1
09/13/96	13.4	3.5		4.3	10.6	4.0	13.9	2.3	10.2	4.3	10.0	4.5
09/14/96	11.7	5.5		4.1	10.6	3.9	12.4	2.9	10.2	3.5	9.6	4.5
09/15/96	11.1	5.2		4.4	10.3	3.8	12.5	3.0	7.0	2.7	8.5	4.0
09/16/96	11.1	5.4		4.7	10.2	4.0	12.3	3.1	7.0	2.2	8.4	3.8
09/17/96	10.9	5.8		4.5	10.2	4.1	12.2	3.1	6.9	2.7	8.3	3.8
09/18/96	10.6	5.4		4.7	9.6	4.4	12.1	3.1	6.3	2.7	8.1	3.9
09/19/96	10.0	4.8		4.9	9.6	4.4	12.0	2.8	6.6	2.8	7.8	4.2
09/20/96	9.6	5.4		4.9	9.3	4.4	11.9	3.3	6.2	3.2	9.2	3.3
09/21/96	9.3	5.1		5.1	9.2	4.5	11.6	3.5	6.3	2.6	7.6	4.1
09/22/96	9.2	4.5		4.9	9.4	4.6	11.9	3.1	6.3	2.7	7.2	4.2
09/23/96	8.9	3.9		5.3	9.3	4.3	11.6	3.4	6.2	2.6	7.2	4.4
09/24/96	9.1	4.9		4.9	9.1	4.5	10.1	3.3	5.8	3.2	7.1	4.3
09/25/96	9.3	5.6		4.8	9.4	4.6	10.6	2.5	10.4	4.3	7.0	4.3
09/26/96	9.1	4.7		5.0	9.1	4.5	9.0	1.6	6.5	2.3	6.9	4.2
09/27/96	8.3	3.3		5.2	8.9	4.5	8.8	1.6	6.0	1.8	7.0	4.7
09/28/96	8.4	3.9		4.9	8.8	4.3	11.9	3.2	5.5	2.4	6.6	4.8
09/29/96	8.1	4.5		5.6	8.7	4.4	10.1	2.9	5.9	2.0	6.6	5.2
09/30/96	7.5	3.8		5.8	8.7	4.6	8.3	2.2	6.0	1.9	6.2	5.1
10/01/96	7.2	3.4		5.9	8.6	4.7	5.9	2.6	5.7	2.2	6.3	5.3
10/02/96	7.4	4.0		4.8	8.5	4.9	7.9	2.3	5.7	1.8	5.8	4.6
10/03/96	7.0	3.2		5.5	8.5	4.8	7.9	2.4	5.5	1.8	5.9	4.9
10/04/96	7.1	3.5		5.1	8.5	4.9	8.0	2.5	5.6	1.8	6.0	5.2
10/05/96	7.4	3.7		4.9	8.7	5.3	5.4	2.8	6.1	1.5	7.3	4.4
10/07/96	6.7	3.2		5.6	8.3	4.9	8.5	2.6	6.2	1.5	7.6	4.5
10/08/96	6.9	3.1		5.4	8.5	5.0	8.2	2.7	5.8	1.5	5.9	5.3
10/09/96	6.6	3.2		5.5	8.3	4.9	8.2	2.7	5.6	1.1	7.4	4.4
10/10/96	6.9	2.5		5.5	8.5	5.2	5.6	2.5	5.0	2.5	7.9	4.6
10/11/96	6.5	2.9		5.2	8.4	4.9	7.8	3.0	5.7	2.0	7.6	4.4
10/12/96	6.1	2.6		5.6	8.2	5.1	7.6	4.9	4.7	2.0	7.2	4.4
10/13/96	6.7	2.9		5.1	8.4	4.9	7.7	2.9	5.7	0.9	7.2	4.4
10/14/96	5.8	2.5		5.4	7.9	5.3	7.6	3.3	4.9	2.1	7.2	4.3
10/15/96	5.8	2.9		5.8	7.9	5.2	7.7	3.6	5.3	2.2	7.1	4.4

10/16/96	6.6	3.0		5.3	7.8	5.1	9.8	3.7	5.4	1.8	7.0	4.2
10/17/96	5.8	3.3		5.3	8.0	5.0	10.1	2.9	4.4	2.1	7.0	4.2
10/18/96	6.2	2.6		5.4	7.8	5.2	5.3	2.8	4.7	1.8	6.9	4.2
10/19/96	5.4	2.5		4.7	8.1	5.0	11.0	3.9	4.6	1.9	6.8	4.3
10/20/96	5.8	2.6		5.2	7.6	5.2	9.6	3.6	5.3	2.7	6.8	4.3
10/21/96	6.4	3.7		5.6	8.2	4.8	9.8	3.2	7.2	4.9	6.7	4.3
10/22/96	5.6	3.3		5.2	7.6	5.3	11.1	3.9	6.8	5.6	7.8	4.1
10/23/96	5.7	2.6		5.5	7.6	5.0	11.0	4.0	5.2	2.8	6.5	4.3
10/24/96	5.6	2.6		5.4	7.6	5.1	9.4	3.7	5.2	1.7	6.9	4.1
10/25/96	6.1	2.8		6.2	7.3	5.1	11.4	2.9	5.4	1.2	6.6	4.2
10/26/96	5.2	2.7		5.3	7.4	5.1	9.6	3.4	5.0	1.5	6.7	4.1
10/27/96	5.5	2.9		6.3	7.6	4.8	9.6	3.5	5.0	2.9	7.1	4.3
10/28/96	5.5	2.8		5.1	7.5	5.2	7.3	3.1	4.6	2.0	6.6	4.2
10/29/96	5.2	2.7		6.3	7.5	5.1	9.7	3.4	4.4	2.3	6.9	4.1
10/30/96	5.3	2.6		6.1	7.5	5.4	10.9	3.7	4.4	2.0	6.5	4.3
11/01/96	5.5	3.0		5.6	7.6	5.3	7.8	3.1	4.5	1.7	6.7	4.4
11/02/96	5.5	2.7		5.4	7.7	5.0	7.6	3.1	4.4	1.7	6.6	4.2
11/03/96	5.2	2.2		6.4	7.6	5.1	7.9	2.8	4.0	2.2	6.4	4.3
11/04/96	5.2	2.6		5.4	7.6	5.1	9.7	3.1	5.0	1.8	6.5	4.2
11/05/96	4.7	3.1		5.7	7.5	4.9	9.1	4.0	4.2	2.6	6.1	4.4
11/06/96	5.3	3.0		0.2	7.3	5.1	4.9	0.5	7.6	5.3	8.7	4.7
11/07/96	23.6	1.5			23.6	0.9	25.9		21.9	2.8	19.6	2.3
11/08/96	23.6	1.3			23.5	0.7	25.3		21.6	3.1	19.3	1.9
11/09/96	24.1	1.5		0.7	24.2	0.9	26.0	0.2	23.5	2.1	20.5	2.1
11/10/96	23.7	0.8		0.2	23.4	1.0	24.7	0.1	21.7	2.3	20.4	1.0
11/11/96	23.4	1.1		0.5	23.0	1.1	24.3		21.3	2.3	20.7	1.1
11/12/96	23.3	0.8			23.1	0.8	24.4		21.1	2.4	21.0	1.3
11/13/96	23.5	1.0		0.3	23.0	0.9	24.5	0.1	21.6	2.9	21.5	1.6
11/14/96	24.4	1.0		0.2	23.7	0.6	24.9	0.1	23.2	2.3	22.3	1.5
11/15/96	24.9	1.0		0.2	24.1	0.6	25.0	0.3	24.3	1.5	22.5	0.5
11/17/96	24.8	0.8			23.9	0.6	25.4	0.2	23.4	2.5	22.1	1.3
11/18/96	25.3	0.9		0.3	24.2	0.7	25.4	0.1	24.1	1.7	22.7	0.9
11/21/96	24.1	1.0			23.4	0.6	25.3	0.4	22.5	2.2	21.8	0.6
11/22/96	24.3	1.2		0.3	23.5	0.7	25.1	0.1	22.5	2.1	21.8	0.8
11/23/96	23.8	0.9		0.4	22.8	0.6	25.2	0.3	21.7	2.3	21.4	1.0
11/24/96	23.9	0.9		0.4	22.7	0.7	24.7	0.1	21.5	2.0	21.3	1.4
11/26/96	24.1	1.3			22.9	0.8	25.2		21.1	2.1	21.1	1.8
11/27/96	23.6	1.8		0.2	22.6	0.9	25.1	0.3	20.2	1.9	21.0	1.7
11/28/96	23.0	2.4		0.1	22.4	1.0	24.8	0.2	19.6	1.5	21.0	1.6
11/29/96	22.4	2.6			21.5	2.4	24.6	0.1	19.2	1.9	21.4	2.1
11/30/96	22.6	3.2		0.4	21.4	2.5	24.6	0.2	19.0	2.0	21.1	2.2
12/01/96	22.0	3.3			21.1	2.4	24.4		18.2	1.8	20.7	2.6

12/02/96	22.0	3.5			20.8	3.0	24.2		18.1	1.8	20.7	2.8
12/04/96	21.2	4.0			20.3	3.0	21.9		17.0	2.4	20.5	3.5
12/05/96	21.3	4.3		2.2	20.8	2.1	22.4	1.2	16.7	2.2	20.2	3.1
12/06/96	20.5	4.2		0.1	20.3	2.5	20.9	0.2	16.2	2.0	19.8	3.7
12/07/96	20.3	4.2		1.0	20.1	2.3	20.8	1.0	16.1	2.6	19.5	3.7
12/08/96	20.0	4.6		1.3	20.1	2.5	20.2	0.6	15.9	2.3	19.6	3.8
12/10/96	19.3	4.2			18.7	3.5	21.2	1.3	15.3	2.2	19.0	3.6
12/11/96	19.1	3.9			19.7	2.6	19.4		15.8	2.4	19.4	3.9
12/12/96	19.1	4.0		0.3	19.8	2.6	19.8	0.3	15.9	1.8	19.1	3.6
12/13/96	19.6	3.9		1.5	20.0	2.9	21.4	1.5	15.4	2.3	19.3	3.8
12/16/96	21.4	1.7			20.0	2.6	23.3		16.4	3.1	19.7	3.0
12/18/96	20.2	3.4		2.8	19.5	2.8	21.9	1.1	15.3	2.5	19.3	3.8
12/19/96	19.7	3.2		2.6	19.6	3.1	21.9	1.2	15.2	2.7	18.9	3.4
12/20/96	19.7	3.8		2.4	19.6	2.9	21.8	1.1	15.0	2.4	19.2	3.5
12/22/96	19.7	3.8			19.3	2.9	22.0		15.4	2.1	19.2	3.9
12/23/96	20.3	1.7	21.7	0.2	19.4	2.9	21.6	0.2	16.2	4.2	19.1	3.4
12/24/96	20.7	2.1	18.2	3.4	19.8	3.2	21.7	1.2	16.4	4.0	19.8	3.0
12/26/96	21.0	2.7	22.2	0.6	19.8	2.9	22.4		15.9	3.4	19.8	3.4
12/27/96	23.5	1.8	25.1	0.4	22.4	1.4	24.9	0.2	21.5	2.8	21.4	2.0
12/29/96	23.2	1.1	22.3	0.7	21.9	1.0	24.2	0.1	20.8	2.4	20.8	1.6
12/31/96	22.6	1.1	23.8	0.4	21.5	1.1	24.0	0.4	19.5	2.1	20.3	1.9
01/03/97	23.2	0.9	24.2	0.4	22.1	1.1	24.4	0.4	21.1	2.2	20.8	1.7
01/04/97	24.4	1.1	25.4	0.3	23.4	0.7	25.3	0.2	23.3	2.9	22.7	1.1
01/05/97	23.7	1.0	25.1	0.4	22.9	0.6	25.0	0.4	22.7	2.7	21.1	1.1
01/07/97	23.5	1.1	22.9	0.6	22.6	1.0	24.8	0.5	21.7	2.6	20.8	1.4
01/08/97	23.4	1.2	23.0	0.9	22.5	1.1	24.9	0.1	21.6	2.5	20.6	1.4
01/09/97	23.3	0.8	22.7	0.9	22.1	0.8	24.6	0.2	21.6	2.8	20.6	1.6
01/10/97	23.4	1.2	24.8	0.4	22.1	1.0	24.9	0.7	21.0	2.9	20.5	1.5
01/12/97	22.5	2.4	25.3	0.5	21.9	1.2	25.7	1.2	19.9	2.4	20.3	1.8
01/13/97	23.4	0.9	21.9	1.9	22.0	1.0	23.9	1.2	22.3	3.5	20.9	1.6
01/14/97	23.5	1.1	23.5	0.3	22.4	0.9	23.7	0.2	21.6	2.9	20.7	1.4
01/15/97	23.3	1.2	23.8	0.2	22.5	1.1	23.9	0.1	21.4	3.2	20.4	1.4
01/16/97	23.7	1.3	24.0	0.1	22.7	0.8	24.1	0.3	24.3	0.6	21.1	1.5
01/17/97	23.2	1.6	23.7	0.2	22.2	0.8	23.7	0.2	21.9	2.9	20.6	1.4

01/18/97	23.0	1.2	23.3	0.1	22.0	0.8	23.5	0.2	21.4	2.9	20.1	1.3
01/19/97	22.9	1.2	23.2	0.3	22.0	0.9	23.5	0.2	21.2	2.7	20.1	1.5
01/20/97	24.1	0.9	24.2	0.1	23.0	0.7	24.4	0.3	23.1	2.9	21.4	1.3
01/21/97	23.9	1.2	24.2	0.4	22.6	0.7	23.9	0.1	22.4	2.9	21.2	1.3
01/22/97	23.9	1.0	24.2	0.3	22.9	0.8	24.2	0.2	23.0	3.1	21.3	1.0
01/23/97	23.4	0.9	23.8	0.3	22.8	0.7	23.7	0.2	21.9	2.9	21.0	0.8
01/24/97	23.5	1.1	23.4	0.1	22.5	1.1	23.4	0.3	21.8	3.1	20.6	1.2
01/25/97	23.2	1.1	23.4	0.3	22.2	0.9	23.0	0.0	21.4	3.1	20.6	1.3
01/26/97	23.3	1.3	23.3	0.3	22.3	0.8	23.4	0.2	21.1	3.1	20.6	1.5
01/27/97	23.1	1.1	23.3	0.2	22.2	1.0	23.3	0.1	21.4	2.9	20.5	1.4
01/28/97	23.2	1.1	23.4	0.3	22.2	1.1	23.4	0.2	21.1	2.9	20.8	1.2
01/29/97	23.1	1.3	23.3	0.3	22.2	1.0	23.4	0.2	21.5	3.3	20.7	1.5
01/30/97	23.5	1.2	24.1	0.3	22.6	1.1	24.0	0.3	22.3	3.8	21.1	0.9
01/31/97	23.8	1.6	24.1	0.1	22.7	1.1	24.2	0.3	22.1	3.3	20.8	1.1
02/01/97	23.7	1.1	24.0	0.3	22.4	1.0	24.1	0.3	21.6	3.2	21.1	1.6
02/02/97	23.5	1.3	23.9	0.2	22.3	1.1	24.0	0.3	21.5	2.8	20.8	1.8
02/05/97	23.0	1.3	23.5	0.3	21.8	1.6	23.4	0.1	20.8	3.6	20.4	1.5
02/06/97	21.3	2.0	23.6	0.1	20.6	3.2	23.4	0.4	20.0	3.2	20.4	1.9
02/07/97	21.0	3.2	23.3	0.2	20.7	3.4	23.3	0.2	19.5	3.2	20.0	2.4
02/08/97	20.3	3.2	23.1	0.3	20.4	3.7	23.1	0.3	19.0	2.9	19.9	2.5
02/09/97	20.2	3.7	22.9	0.1	19.9	3.9	22.7	0.2	18.5	3.0	19.7	2.8
02/10/97	18.5	2.4	22.9	0.3	19.7	4.0	22.6	0.2	17.9	2.8	19.3	3.2
02/11/97	19.0	3.8	22.3	0.4	19.2	3.8	21.6	1.2	17.5	2.8	18.8	3.2
02/12/97	18.7	4.0	20.4	1.6	19.0	4.3	19.7	1.5	16.2	1.9	18.5	3.5
02/13/97	17.2	2.7	18.5	0.4	19.1	4.0	18.3	0.1	15.5	1.8	18.2	3.7
02/14/97	17.6	4.5	16.6	0.4	17.9	4.4	17.0	0.3	15.5	1.9	17.3	4.0
02/16/97	16.2	3.2	16.0	0.3	17.7	4.0	16.2	0.4	14.2	1.2	17.0	4.2
02/17/97	15.8	2.9	15.5	0.4	16.6	3.8	15.7	0.1	14.0	0.5	16.7	4.5
02/18/97	15.8	3.6	15.2	0.2	17.2	4.4	15.3	0.2	13.6	1.0	16.6	4.3
02/19/97	15.3	3.0	14.5	0.2	16.1	3.3	14.6	0.3	13.6	1.0	16.0	4.1
02/20/97	15.8	3.9	14.4	0.3	15.6	3.4	14.3	0.2	13.0	1.0	15.1	3.2
02/21/97	14.6	3.0	14.1	0.3	15.6	3.2	13.9	0.4	12.7	0.8	14.9	3.5
02/22/97	14.6	4.9	13.5	0.2	14.9	3.2	13.5	0.2	13.0	1.1	14.6	3.3
02/23/97	15.1	4.4	13.4	0.2	14.6	3.0	13.7	0.1	12.7	1.4	14.9	3.9
02/24/97	15.5	4.9	13.9	0.6	14.0	3.3	13.4	0.3	11.9	0.9	14.7	4.2
02/25/97	15.7	5.1	13.6	0.2	14.1	3.2	13.7	0.5	12.0	1.0	14.5	3.9
02/26/97	14.5	4.2	13.7	0.5	14.9	3.6	13.6	0.3	12.0	0.9	14.1	3.6
02/27/97	14.4	3.7	13.3	0.5	14.7	3.3	13.0	0.2	12.0	1.4	14.0	3.6
02/28/97	14.7	4.2	13.6	0.2	14.7	3.3	13.4	0.4	12.8	1.4	14.5	4.1
03/02/97	15.6	4.7	13.7	0.2	14.9	3.3	13.5	0.2	12.1	1.3	14.1	3.8
03/03/97	15.2	4.5	13.6	0.2	14.9	3.4	13.4	0.2	11.8	1.4	14.0	3.7
03/04/97	13.1	4.9	13.3	0.2	14.3	3.3	13.6	0.3	11.5	1.0	14.2	3.8
03/05/97	14.7	5.0	13.7	0.4	16.2	1.4	13.2	0.5	14.8	4.9	13.7	3.3

03/06/97	15.1	4.3	13.5	0.3	14.6	3.3	13.7	0.4	15.1	5.0	14.0	3.8
03/07/97	15.1	5.2	13.6	0.2	14.7	3.3	13.5	0.5	14.2	3.8	13.8	3.7
03/08/97	13.7	4.1	13.2	0.3	14.5	3.2	13.5	0.3	13.7	4.0	13.8	3.6
03/09/97	12.6	4.7	13.2	0.4	14.1	3.4	13.4	0.4	13.9	4.0	13.4	3.8
03/10/97	13.6	4.6	13.3	0.2	14.0	3.5	13.1	0.2	13.1	3.9	13.4	3.6
03/11/97	17.4	1.9	19.3	0.1	17.5	1.1	19.1	0.3	18.2	5.0	16.4	1.1
03/12/97	18.1	2.4	20.5	0.2	18.4	1.4	20.6	0.0	18.1	4.4	16.8	1.5
03/13/97	18.7	2.5	21.6	0.2	19.1	1.6	21.6	0.2	19.9	4.1	17.7	1.4
03/14/97	19.0	2.6	22.4	0.3	19.1	2.1	22.3	0.2	20.1	3.6	17.7	2.0
03/15/97	19.2	2.6	22.5	0.1	18.9	1.8	22.7	0.2	20.2	3.8	18.0	1.8
03/16/97	19.3	2.5	22.5	0.2	19.0	2.1	22.8	0.1	20.1	3.8	17.5	2.0
03/17/97	24.3	1.9	24.9	0.2	22.2	1.4	25.0	0.2	23.4	2.5	20.5	0.9
03/18/97	23.1	0.9	23.4	0.2	21.6	0.9	23.5	0.2	21.4	3.1	19.7	0.8
03/19/97	22.6	1.0	23.2	0.3	21.2	0.6	22.9	0.2	21.1	2.8	19.1	1.2
03/20/97	21.9	1.5	22.9	0.1	21.2	0.6	22.9	0.3	20.7	3.1	19.5	1.3
03/21/97	21.6	1.9	22.7	0.2	21.1	0.9	22.4	0.1	20.0	2.6	19.1	1.3
03/22/97	21.0	2.4	22.4	0.3	20.8	0.8	22.4	0.3	19.9	2.5	18.6	1.2
03/23/97	23.6	0.9	24.7	0.3	22.6	0.7	24.4	0.2	22.8	2.6	20.9	1.1
03/26/97	23.6	1.0	24.1	0.2	22.3	0.7	24.0	0.3	22.0	2.5	20.7	1.4
03/27/97	23.4	1.2	23.8	0.1	22.2	0.9	23.9	0.2	21.9	2.4	20.0	1.3
03/28/97	22.9	0.7	23.7	0.2	22.4	1.0	23.4	0.2	21.5	2.3	20.3	1.3
03/29/97	22.7	1.1	23.0	0.1	21.8	0.9	23.2	0.4	20.9	2.7	19.7	1.9
03/30/97	21.3	2.0	22.2	1.0	21.7	1.4	22.7	0.1	20.6	2.3	19.4	1.8
03/31/97	20.7	2.5	19.2	0.5	21.7	1.1	20.4	1.3	20.4	2.8	19.5	2.5
04/01/97	25.0	0.6	25.0	0.4	23.6	0.5	24.8	0.4	25.8	1.0	22.1	1.3
04/02/97	24.5	0.9	24.8	0.2	23.0	0.7	24.9	0.2	23.3	2.2	21.4	1.5
04/03/97	24.0	1.0	24.2	0.4	22.7	0.6	24.4	0.2	22.5	2.3	21.2	2.2
04/04/97	23.8	1.0	23.9	0.2	22.6	1.0	24.0	0.1	21.9	2.8	21.3	2.2
04/05/97	23.5	1.1	23.7	0.4	22.5	1.0	23.9	0.0	22.1	2.7	21.3	2.6
04/06/97	23.5	1.4	23.5	0.3	22.3	1.1	23.6	0.2	21.9	3.0	20.9	2.7
04/07/97	22.9	1.1	23.2	0.2	22.1	1.3	23.3	0.1	21.3	2.7	20.9	3.1
04/08/97	21.6	2.7	23.0	0.3	21.9	1.0	23.1	0.3	21.5	2.8	20.8	2.8
04/09/97	21.6	3.0	22.5	0.1	21.8	1.3	21.3	1.6	20.3	3.0	20.3	3.1
04/10/97	21.1	3.2	19.4	0.4	21.5	1.7	19.5	0.4	20.0	2.6	20.1	3.2
04/11/97	19.9	3.1	18.5	0.3	21.0	1.9	18.2	0.2	19.1	2.4	19.7	3.6
04/12/97	19.4	2.8	18.0	0.3	20.2	2.7	18.2	0.2	18.0	2.2	19.6	3.8
04/13/97	19.3	2.3	17.5	0.2	20.5	2.3	17.5	0.2	17.5	2.0	19.2	4.0
04/14/97	18.6	2.3	16.7	0.1	20.3	2.5	17.0	0.4	17.1	2.2	18.8	4.4
04/15/97	18.1	3.3	16.4	0.2	20.0	2.2	16.3	0.1	16.7	2.1	18.3	4.9
04/16/97	17.1	3.9	16.1	0.4	19.5	2.7	16.1	0.2	15.9	2.2	17.7	4.8
04/17/97	16.6	2.5	15.6	0.3	19.0	2.6	15.5	0.2	15.5	1.7	17.3	5.0
04/18/97	16.2	2.3	15.0	0.1	17.7	4.2	14.8	0.3	14.5	1.6	16.6	4.9
04/19/97	16.3	4.1	14.8	0.3	17.4	3.9	14.7	0.2	15.3	2.3	16.4	4.9
04/20/97	15.3	2.4	14.3	0.3	17.0	4.2	14.4	0.3	13.9	1.2	16.2	5.0
04/21/97	15.2	2.5	14.2	0.1	16.3	4.0	14.0	0.1	13.7	1.0	15.5	4.7

04/22/97	15.6	3.7	14.0	0.1	16.2	4.2	13.4	0.2	13.4	1.6	15.4	4.6
04/27/97	14.6	3.7	12.9	0.4	16.0	2.1	12.7	0.2	12.0	1.6	14.4	4.3
04/28/97	14.3	4.0	12.7	0.1	14.4	3.7	12.7	0.4	12.3	1.7	13.9	3.9
04/29/97	14.3	3.8	12.7	0.1	14.2	3.8	12.6	0.2	12.0	1.8	13.9	4.0
04/30/97	13.2	2.6	12.6	0.3	13.1	3.1	12.7	0.3	11.6	1.4	13.9	4.0
05/01/97	12.9	2.7	12.5	0.3	15.1	2.0	12.3	0.4	10.8	1.5	13.5	4.0
05/02/97	12.8	3.1	12.2	0.4	13.7	3.2	12.1	0.5	10.6	1.6	13.2	3.8
05/03/97	13.3	4.2	12.7	0.2	12.2	3.5	12.2	0.5	10.4	2.3	10.3	5.0
05/04/97	13.3	4.1	11.9	0.5	12.4	3.3	12.1	0.4	12.5	1.6	11.1	6.2
05/05/97	13.9	3.2	11.3	0.2	12.0	3.6	11.4	0.4	12.1	2.1	9.9	4.9
05/06/97	19.6	1.3	23.3	0.2	21.0	1.8	23.3	0.2	22.4	2.0	20.5	1.1
05/07/97	19.8	1.5	23.6	0.4	21.1	1.3	23.6	0.3	21.6	2.3	20.0	0.8
05/08/97	19.9	1.8	23.6	0.2	20.8	1.1	23.5	0.4	21.3	2.8	19.8	0.7
05/09/97	19.7	1.8	23.5	0.2	20.7	1.0	23.7	0.3	20.9	2.5	19.6	0.7
05/10/97	19.4	1.7	23.0	0.3	20.3	0.7	23.1	0.3	21.0	2.9	19.1	1.1
05/11/97	19.5	1.8	22.9	0.3	20.2	0.8	23.1	0.2	20.4	2.8	19.2	1.0
05/12/97	19.4	1.8	22.7	0.1	19.8	0.8	23.0	0.4	20.0	2.5	18.9	1.1
05/13/97	19.5	2.0	23.0	0.2	19.9	0.5	22.8	0.2	20.5	3.3	19.1	0.6
05/14/97	19.4	1.9	22.7	0.2	19.8	0.7	22.9	0.3	20.5	3.1	18.7	1.2
05/15/97	19.8	1.9	22.9	0.2	20.3	0.6	23.2	0.3	21.5	2.2	19.2	1.2
05/16/97	19.9	2.2	23.2	0.2	20.1	0.7	23.3	0.3	20.8	2.8	18.6	1.6
05/17/97	18.9	2.4	23.0	0.3	19.8	0.8	23.3	0.2	20.6	2.8	18.4	1.6
05/18/97	18.2	2.9	22.9	0.2	19.5	1.1	23.0	0.2	20.3	2.9	17.9	2.2
05/19/97	17.8	3.1	22.8	0.4	19.1	1.4	22.8	0.2	19.7	2.5	17.1	2.3
05/20/97	17.0	3.8	22.2	0.3	18.4	1.6	22.6	0.3	18.0	2.0	16.6	2.7
05/21/97	16.2	3.6	21.9	0.1	17.8	1.5	22.0	0.3	16.9	1.9	16.0	3.1
05/22/97	17.9	2.2	21.5	0.2	17.4	1.8	21.5	0.3	16.9	2.4	15.6	3.3
05/23/97	16.1	3.5	21.1	0.2	16.9	1.8	21.4	0.1	16.6	2.4	15.1	3.2
05/24/97	15.7	4.0	20.9	0.4	16.4	1.9	21.0	0.2	15.8	1.6	15.0	3.5
05/25/97	15.4	3.9	20.4	0.2	16.0	1.9	20.4	0.4	15.4	1.3	14.4	3.8
05/26/97	15.4	4.0	18.8	1.2	15.6	2.0	19.3	1.0	14.5	1.9	14.2	3.7
05/29/97	13.8	3.9	13.8	0.2	13.5	3.6	14.0	0.1	13.0	1.7	13.5	3.8
05/30/97	12.7	3.1	13.4	0.2	13.3	3.6	13.3	0.2	12.7	0.9	13.1	4.2
05/31/97	13.3	4.5	12.6	0.2	13.1	3.9	12.5	0.3	12.0	1.7	12.9	3.6
06/01/97	14.2	3.7	12.9	0.6	13.3	3.5	12.7	0.2	11.4	1.6	13.3	3.8
06/02/97	13.4	4.6	12.2	0.1	13.1	3.6	12.5	0.4	11.4	1.8	11.4	3.2
06/03/97	16.0	1.9	12.3	0.5	13.0	3.8	12.8	0.3	13.0	2.5	12.8	3.8
06/04/97	13.1	4.3	12.4	0.2	12.8	3.7	12.2	0.1	12.9	2.3	12.7	3.7
06/05/97	13.4	4.4	12.4	0.4	12.9	3.7	12.4	0.2	11.1	2.1	12.7	4.3
06/06/97	13.0	4.8	11.9	0.2	12.6	3.8	11.6	0.3	10.9	2.0	12.5	3.9
06/07/97	13.2	4.6	11.7	0.2	12.6	4.0	11.9	0.3	12.5	1.8	12.4	3.7

06/08/97	12.7	4.8	11.4	0.2	13.2	3.4	11.5	0.2	12.3	1.9	12.5	3.9
06/09/97	11.6	5.1	11.5	0.3	12.9	3.1	11.4	0.4	11.9	2.2	12.7	4.5
06/10/97	11.3	4.3	11.0	0.3	12.5	4.0	11.2	0.3	12.3	2.1	12.4	4.4
06/11/97	10.8	2.8	11.0	0.1	11.8	3.5	10.9	0.2	12.1	2.3	12.6	3.5
06/12/97	12.4	4.9	11.0	0.3	12.2	3.9	10.7	0.3	12.2	2.3	8.9	4.6
06/13/97	11.4	3.3	10.8	0.2	12.1	3.9	10.8	0.3	12.0	2.3	10.3	6.2
06/14/97	12.2	5.0	10.9	0.1	11.6	4.0	10.7	0.2	11.8	2.5	10.2	6.1
06/15/97	11.1	4.9	10.3	0.2	11.5	3.8	10.6	0.3	9.9	1.9	8.7	4.6
06/16/97	11.4	3.7	10.1	0.3	11.1	3.9	10.2	0.3	9.3	1.6	10.1	6.2
06/17/97	12.1	5.1	10.1	0.1	11.4	3.5	10.1	0.1	11.5	2.7	9.9	6.0
06/18/97	10.9	5.2	10.0	0.1	12.4	3.5	10.2	0.2	11.5	2.7	9.8	6.4
06/19/97	10.3	3.9	9.7	0.2	11.1	3.8	10.0	0.1	11.5	2.4	10.0	6.2
06/20/97	10.0	3.3	9.6	0.4	11.3	3.8	9.6	0.0	11.2	2.5	9.9	5.9
06/21/97	10.2	4.5	9.6	0.1	11.3	3.6	9.3	0.0	9.1	1.9	8.4	4.9
06/22/97	10.8	5.2	9.5	0.2	11.2	3.7	9.5	0.2	9.1	1.8	8.2	4.9
06/23/97	9.7	4.1	9.3	0.1	10.7	4.1	9.4	0.2	9.1	1.7	8.3	4.6
06/24/97	10.6	3.8	9.4	0.2	10.8	3.9	9.2	0.3	11.0	2.9	8.7	4.7
06/26/97	9.5	3.7	7.9	0.2	12.2	3.2	7.8	0.1	8.9	1.5	9.8	6.3
06/27/97	9.4	3.7	7.5	0.1	10.5	4.4	7.5	0.2	9.1	1.4	9.1	5.3
06/28/97	10.0	5.5	7.5	0.1	11.8	3.2	7.7	0.2	9.0	1.5	9.6	6.0
06/29/97	8.9	3.2	7.2	0.3	10.6	4.0	7.3	0.2	11.0	3.1	9.4	6.1
06/30/97	9.3	3.2	7.1	0.2	10.5	4.0	7.1	0.0	7.2	4.8	9.2	6.2
07/01/97	8.8	3.4	7.0	0.1	10.7	4.0	7.0	0.1	6.9	4.6	8.3	4.8
07/02/97	9.4	4.0	7.2	0.1	10.3	4.1	7.3	0.4	6.9	4.6	8.1	4.6
07/03/97	8.9	3.5	7.3	0.2	10.7	4.1	7.1	0.2	7.0	4.7	8.4	4.5
07/04/97	9.2	3.5	7.2	0.2	10.5	4.0	7.1	0.1	6.9	4.6	9.4	6.1
07/05/97	9.1	3.5	6.9	0.2	10.4	4.1	6.9	0.3	11.6	5.5	7.9	4.9
07/06/97	9.0	3.5	6.8	0.3	10.2	4.2	6.8	0.1	11.0	4.3	7.7	4.9
07/07/97	8.4	3.1	6.7	0.1	10.3	4.1	6.9	0.1	10.9	4.3	7.8	4.8
07/08/97	8.3	3.4	6.6	0.2	9.9	4.4	6.7	0.2	6.8	4.5	9.0	5.7
07/09/97	8.4	3.5	6.6	0.2	10.0	4.1	6.7	0.2	7.3	3.2	8.1	5.0
07/10/97	8.3	3.3	6.5	0.1	10.1	4.1	6.4	0.2	7.7	2.3	8.9	5.8
07/11/97	8.4	3.3	6.5	0.3	11.3	3.6	6.6	0.2	10.6	3.1	9.3	6.2
07/12/97	8.2	2.9	6.6	0.2	10.1	4.2	6.4	0.1	6.6	4.4	9.3	6.4
07/13/97	8.5	3.2	6.5	0.1	10.3	4.4	6.5	0.1	10.8	3.0	8.3	4.5
07/14/97	8.2	3.3	6.4	0.3	11.0	3.9	6.5	0.2	10.5	3.6	9.3	6.4
07/15/97	8.4	3.2	6.6	0.3	10.4	4.2	6.5	0.2	6.7	4.5	8.2	5.5
07/16/97	8.0	3.0	6.5	0.1	10.1	4.3	6.4	0.1	7.3	2.6	7.8	4.7
07/17/97	8.3	2.6	6.3	0.2	10.2	4.4	6.3	0.3	6.5	4.3	7.5	4.6
07/18/97	8.1	2.7	6.3	0.2	10.2	4.1	6.6	0.3	7.0	2.3	8.7	5.9
07/19/97	8.3	2.7	6.5	0.3	10.1	4.4	6.5	0.2	7.3	2.9	7.5	4.8
07/20/97	8.0	3.1	6.2	0.3	9.6	4.6	6.3	0.1	7.4	2.5	8.6	5.8
07/21/97	16.0	2.5	6.5	0.4	15.3	2.9	6.4	0.1	17.6	4.1	13.3	2.6
07/22/97	15.6	2.6	6.7	0.3	15.0	2.7	6.7	0.1	14.8	3.7	13.3	2.5
07/23/97	14.6	2.9	6.7	0.1	14.5	2.7	6.8	0.1	14.8	3.6	13.2	2.9
07/24/97	14.4	3.8	7.1	0.2	14.3	2.8	7.0	0.2	14.3	3.8	12.7	2.7

07/25/97	13.8	3.9	7.1	0.2	14.0	2.9	7.0	0.1	13.7	3.8	12.0	3.9
07/26/97	13.6	4.3	7.3	0.4	13.7	2.8	7.5	0.2	12.4	2.1	11.3	4.3
07/27/97	13.7	4.1	7.1	0.2	13.5	2.7	7.0	0.1	11.5	2.2	10.4	5.5
07/28/97	13.3	4.4	7.2	0.2	13.3	2.8	7.5	0.4	11.4	1.9	9.9	5.7
07/29/97	16.6	2.8	7.2	0.4	15.1	2.0	7.4	0.2	15.0	4.8	13.7	2.4
07/30/97	15.5	2.5	7.6	0.1	14.7	2.2	7.6	0.3	14.4	4.0	13.2	2.3
07/31/97	14.2	3.0	7.5	0.3	14.2	2.5	7.4	0.2	13.9	4.0	13.1	2.0
08/01/97	13.9	3.8	7.8	0.0	13.6	2.6	7.7	0.1	12.1	2.6	11.4	4.4
08/02/97	13.7	3.9	7.8	0.3	13.6	2.6	7.7	0.2	10.0	3.0	10.4	5.7
08/03/97	13.6	4.2	7.7	0.1	13.2	2.6	7.7	0.1	9.1	2.8	10.3	5.6
08/04/97	12.4	4.6	7.7	0.1	11.9	3.3	7.6	0.1	8.7	2.5	10.0	5.8
08/05/97	12.3	4.6	7.5	0.1	13.0	2.8	7.4	0.1	8.2	2.6	9.7	6.1
08/06/97	10.8	4.9	7.3	0.2	12.0	3.3	7.2	0.1	8.0	2.5	9.9	5.9
08/07/97	11.2	3.6	7.2	0.2	11.5	3.8	7.2	0.3	7.7	2.9	8.7	5.1
08/08/97	10.2	5.5	7.2	0.1	10.6	3.9	6.8	0.2	7.0	4.7	8.5	4.5
08/09/97	9.2	2.9	6.9	0.3	11.6	3.9	7.1	0.1	11.6	4.5	8.2	4.4
08/10/97	9.2	3.3	6.6	0.3	10.5	4.1	6.8	0.1	11.6	5.7	8.2	4.4
08/11/97	8.5	2.6	6.6	0.1	10.2	4.4	6.8	0.2	12.1	6.5	8.2	4.5
08/12/97	9.9	3.3	6.5	0.3	10.0	4.2	6.5	0.1	13.0	8.6	7.6	4.8
08/13/97	8.4	2.4	6.4	0.2	10.1	4.7	6.4	0.1	12.2	8.1	7.7	4.6
08/14/97	9.7	3.5	6.6	0.4	9.9	4.5	6.4	0.2	12.3	7.2	7.7	4.6
08/15/97	8.1	2.5	6.3	0.2	9.5	4.9	6.5	0.2	11.6	7.0	7.7	4.8
08/16/97	8.1	2.5	6.1	0.1	9.4	4.8	6.3	0.1	11.4	7.1	7.5	4.6
08/17/97	7.8	2.4	6.3	0.3	9.4	4.9	6.2	0.1	11.8	5.7	8.3	5.8
08/18/97	8.0	2.4	6.3	0.1	9.4	4.8	6.2	0.1	6.6	4.4	8.9	5.4
08/19/97	7.5	2.5	6.1	0.1	9.4	5.1	6.2	0.1	11.0	5.5	8.7	5.9
08/20/97	9.6	3.3	6.2	0.1	9.3	4.8	6.3	0.2	6.6	4.5	8.5	6.0
08/21/97	7.9	2.7	6.2	0.2	9.3	5.2	6.3	0.2	6.0	4.0	8.5	5.9
08/22/97	7.7	2.5	6.2	0.2	9.3	4.8	6.3	0.2	5.8	3.9	8.8	6.3
08/23/97	7.8	2.5	6.3	0.2	9.3	4.8	6.3	0.2	5.9	4.0	8.7	6.0
08/24/97	7.9	2.9	6.3	0.2	9.2	4.9	6.3	0.2	5.8	3.9	8.2	5.3
08/25/97	7.5	2.3	6.2	0.1	9.2	4.9	6.0	0.2	10.8	6.7	8.1	5.2
08/26/97	7.6	2.5	6.2	0.4	9.1	5.1	6.2	0.1	5.7	3.8	8.6	6.1
08/27/97	9.0	3.4	6.0	0.2	8.8	5.2	6.0	0.2	10.8	6.8	7.5	4.9
08/28/97	7.2	2.4	6.1	0.1	9.1	5.0	5.9	0.1	5.7	3.8	8.2	6.0
08/29/97	7.2	2.3	6.2	0.2	9.0	4.8	6.3	0.2	10.5	5.6	7.5	4.9
08/30/97	7.4	2.5	6.0	0.2	9.2	5.0	6.0	0.2	10.7	5.6	7.2	4.8
08/31/97	7.3	2.5	6.2	0.2	9.1	5.2	6.2	0.1	6.0	4.1	8.2	5.8
09/01/97	7.4	2.8	6.0	0.1	9.2	4.8	6.1	0.3	5.8	3.9	7.1	4.8
09/02/97	7.6	2.8	6.1	0.1	9.0	5.2	6.3	0.1	10.4	4.8	7.2	4.6
09/03/97	7.2	2.6	6.3	0.3	8.8	5.2	6.1	0.1	6.9	1.1	7.2	4.9
09/04/97	7.0	2.3	5.9	0.2	8.7	5.2	5.8	0.1	6.2	2.1	6.8	4.7
09/05/97	7.3	2.2	6.0	0.2	8.6	5.5	6.2	0.0	6.4	1.7	7.4	4.5
09/06/97	6.6	2.5	6.1	0.1	8.7	5.5	5.9	0.2	5.9	2.3	7.6	5.4
09/07/97	6.5	2.1	5.8	0.3	8.4	5.2	5.9	0.1	5.6	2.8	6.7	4.4
09/08/97	6.5	1.9	6.0	0.1	8.5	5.7	6.0	0.1	5.8	1.7	7.3	5.0
09/09/97	6.8	1.9	5.9	0.1	8.5	5.5	5.9	0.0	5.1	3.4	7.7	5.7

09/10/97	6.3	2.5	6.2	0.1	8.3	5.3	6.1	0.1	6.2	2.0	7.3	5.0
09/11/97	6.9	2.7	5.8	0.3	8.4	5.3	5.8	0.1	6.4	1.9	6.5	4.7
09/12/97	6.6	2.4	5.7	0.3	8.4	5.5	5.8	0.1	6.2	1.4	7.1	5.0
09/13/97	6.3	2.3	5.9	0.4	8.6	5.4	5.8	0.3	7.1	3.3	7.5	5.5
09/14/97	6.6	2.3	6.0	0.3	8.5	5.1	5.9	0.2	6.5	1.1	8.1	5.7
09/15/97	6.4	1.9	5.9	0.3	8.8	5.2	5.8	0.2	6.4	1.5	7.3	5.9
09/16/97	6.6	1.8	5.7	0.5	8.4	5.4	5.7	0.1	6.0	2.1	6.5	4.3
09/17/97	6.3	2.4	5.6	0.3	8.3	5.3	5.8	0.4	6.1	1.8	8.1	6.5
09/18/97	5.9	2.0	5.4	0.2	9.3	4.9	5.9	0.7	8.0	4.3	8.4	5.1
09/19/97	6.7	3.0	5.7	0.2	8.7	5.1	5.4	0.4	6.5	3.2	7.3	4.7
09/20/97	6.1	1.9	5.8	0.5	8.4	5.2	6.3	0.4	6.9	3.0	8.7	6.0
09/21/97	6.2	1.7	5.8	0.6	8.7	5.0	5.9	0.3	6.7	2.8	6.6	4.6
09/22/97	6.3	2.2	5.6	0.4	8.6	5.4	6.1	0.4	7.0	2.3	7.4	5.4
09/23/97	6.9	3.0	5.5	0.3	8.7	5.2	5.7	0.5	6.6	3.7	6.7	4.6
09/24/97	6.1	2.3	5.9	0.5	8.5	5.2	6.0	0.5	9.8	4.9	8.1	6.2
09/25/97	6.3	1.8	6.1	0.4	8.9	5.0	6.0	0.3	8.9	5.0	6.5	4.6
09/26/97	6.4	2.1	6.1	0.5	8.2	5.2	6.3	0.7	6.6	0.7	6.6	4.7
09/27/97	6.8	2.5	6.1	0.6	8.6	5.2	5.4	0.2	6.4	2.0	7.4	5.3
09/28/97	6.8	2.7	5.8	0.7	8.8	5.3	5.7	0.5	6.4	2.5	7.0	4.7
09/29/97	6.3	1.9	5.7	0.6	9.9	4.6	5.9	0.3	6.7	1.8	8.2	6.0
09/30/97	6.5	2.0	5.7	0.2	8.5	5.2	5.5	0.6	7.0	1.1	7.9	6.0
10/01/97	6.9	3.2	5.8	0.2	10.3	4.0	5.6	0.4	7.4	3.0	8.3	6.1
10/02/97	14.2	1.9	6.0	0.3	13.4	3.1	6.2	0.2	11.9	7.3	9.8	5.8
10/03/97	12.9	5.6	6.4	0.3	13.3	2.6	6.5	0.4	14.4	4.6	10.1	5.8
10/04/97	14.8	2.3	7.1	0.8	13.8	2.6	6.8	0.2	14.5	4.1	10.3	5.8
10/05/97	15.2	2.5	7.4	0.3	13.9	2.8	7.7	0.3	14.3	4.2	10.1	5.4
10/06/97	13.2	5.1	7.8	0.1	13.6	2.6	7.4	0.4	13.3	3.3	10.4	5.3
10/07/97	14.7	2.4	7.6	0.7	13.2	2.6	7.4	0.4	12.6	2.4	9.8	6.0
10/08/97	14.7	2.6	7.2	0.2	13.1	3.1	8.0	0.3	11.9	2.3	9.6	6.1
10/09/97	13.5	5.3	16.5	0.3	13.5	3.2	16.7	0.4	14.5	3.6	10.5	4.4
10/10/97	15.3	2.5	16.9	0.5	13.8	3.1	17.2	0.3	15.0	4.3	13.3	2.5
10/11/97	15.3	2.5	17.1	0.4	13.8	3.2	17.2	0.1	14.7	4.0	12.7	2.2
10/12/97	15.7	2.9	17.2	0.6	13.7	3.4	18.1	0.2	15.0	4.3	12.8	2.4
10/13/97	15.1	2.5	17.8	0.4	13.7	3.3	17.0	0.2	14.4	3.7	12.9	2.4
10/14/97	15.5	2.7	17.7	0.5	13.8	3.4	16.9	0.2	13.9	3.7	12.7	2.8
10/15/97	15.3	2.4	17.2	0.4	13.5	3.2	17.3	0.5	13.2	3.1	12.1	2.9
10/16/97	12.8	3.3	16.6	0.4	13.1	3.1	16.2	1.7	12.0	1.8	10.0	5.9
10/17/97	12.7	3.6	15.8	1.6	13.0	3.0	15.3	1.8	11.1	1.8	9.8	6.2
10/18/97	10.8	4.9	12.3	0.2	12.6	2.9	12.5	0.3	10.6	1.9	9.5	6.5
10/19/97	10.7	2.2	11.0	0.3	12.6	2.9	11.2	0.6	9.9	2.0	9.3	6.3
10/20/97	9.9	4.6	10.0	0.4	11.0	4.0	10.2	0.2	9.8	2.0	8.9	6.2
10/21/97	11.3	4.1	9.3	0.7	11.0	3.8	8.9	0.4	9.5	2.0	8.9	6.6
10/22/97	11.2	4.3	8.5	0.3	12.2	2.9	8.9	0.3	7.3	2.6	8.7	6.3
10/23/97	10.0	3.3	8.0	0.3	10.6	4.5	8.2	0.4	7.0	2.2	8.8	6.4
10/24/97	8.2	3.5	7.6	0.1	10.3	4.1	7.9	0.6	9.9	3.4	8.6	6.2
10/25/97	9.2	3.0	7.3	0.4	10.2	4.2	7.5	0.3	9.5	3.5	8.6	6.5
10/26/97	8.0	2.9	7.2	0.3	10.0	4.6	7.1	0.2	10.3	4.0	8.5	6.3

10/27/97	7.2	2.8	6.6	0.5	10.0	4.4	6.6	0.1	9.5	3.9	8.3	6.4
10/28/97	8.8	3.1	7.0	0.3	9.8	4.4	6.8	0.3	10.0	5.4	8.1	6.4
10/29/97	7.7	2.8	6.7	0.3	8.7	5.0	6.9	0.1	5.6	3.8	8.1	6.5
10/30/97	7.3	1.9	6.5	0.3	9.7	4.9	6.4	0.4	5.5	3.7	7.9	6.3
10/31/97	13.5	6.1	17.4	0.5	15.6	1.6	17.1	0.4	17.8	3.7	11.9	6.1
11/01/97	15.4	2.6	19.0	0.9	15.4	2.0	18.1	0.6	15.6	3.5	12.1	4.9
11/02/97	15.2	2.9	18.1	0.5	15.5	2.4	17.8	0.1	15.3	3.2	11.8	5.0
11/03/97	15.4	2.6	16.6	1.3	15.1	2.5	18.0	0.2	15.2	3.4	12.8	2.4
11/04/97	16.6	3.3	19.2	0.3	16.5	2.8	19.4	0.1	17.1	3.9	14.8	2.8
11/05/97	15.2	6.5	19.9	0.1	16.4	3.1	20.1	0.2	17.2	3.8	14.6	2.9
11/06/97	16.1	3.5	20.0	0.1	16.6	3.0	20.0	0.3	17.1	4.0	14.4	3.0
11/07/97	16.7	3.8	20.5	0.3	16.2	2.7	20.3	0.5	16.3	3.7	14.3	2.9
11/08/97	16.5	3.5	20.1	0.1	16.0	3.0	20.1	0.3	15.9	3.3	14.0	3.1
11/09/97	13.8	6.2	20.2	0.6	15.7	3.5	20.1	0.3	15.5	3.9	13.5	3.4
11/10/97	15.0	3.8	20.1	0.2	15.3	3.7	19.9	0.6	14.8	3.1	13.1	3.4
11/11/97	14.1	3.6	18.3	1.8	15.0	3.5	17.8	1.3	13.6	2.5	12.6	3.5
11/12/97	14.4	3.8	17.2	1.5	14.8	3.6	17.5	1.4	13.8	2.9	12.4	3.5
11/13/97	13.2	4.0	15.3	0.2	14.6	3.6	15.3	0.4	13.1	2.5	10.5	6.4
11/14/97	12.7	2.8	14.3	0.5	14.1	3.6	14.2	0.3	11.5	1.9	9.9	6.5
11/15/97	11.3	2.2	13.3	0.6	13.8	3.4	13.5	0.6	11.1	2.0	9.6	6.8
11/16/97	10.9	2.2	12.3	0.4	12.5	4.3	12.0	0.6	10.3	1.4	9.3	6.5
11/17/97	11.6	2.8	11.5	0.6	13.5	3.3	11.1	0.2	9.8	1.8	9.0	6.2
11/18/97	10.7	2.4	11.9	0.2	13.4	3.1	13.4	2.4	12.8	3.9	9.3	6.4
11/19/97	11.7	4.2	17.9	0.6	13.3	2.8	17.9	0.1	12.7	4.0	9.1	6.3
11/20/97	11.5	2.8	16.5	2.0	13.3	3.1	16.1	2.2	13.1	3.9	9.2	6.5
11/21/97	12.5	4.5	12.4	0.4	13.0	2.9	14.9	2.8	11.3	2.5	9.1	6.1
11/22/97	11.7	4.2	13.7	2.3	13.0	2.8	12.3	0.2	11.5	2.8	9.1	6.2
11/23/97	8.5	3.5	11.4	0.4	13.0	2.9	11.5	0.7	11.2	2.7	9.0	6.2
11/24/97	12.2	4.7	10.6	0.2	12.8	2.8	10.5	0.2	10.5	2.4	8.8	6.2
11/25/97	9.5	2.5	9.9	0.4	12.5	2.9	9.9	0.4	10.1	2.5	8.5	6.2
11/26/97	8.2	3.1	9.3	0.3	12.8	3.0	9.7	0.3	10.1	2.4	8.7	6.2
11/27/97	8.8	3.3	9.4	0.5	13.0	2.6	9.4	0.4	12.1	4.1	9.0	6.2
11/28/97	12.0	4.3	9.6	0.3	13.0	2.9	9.6	0.2	12.3	3.9	10.2	6.6
11/29/97	12.2	4.9	9.4	0.2	13.0	3.0	9.2	0.4	11.8	4.1	9.1	5.8
11/30/97	11.3	4.7	10.5	0.5	13.4	3.0	10.2	0.3	13.9	4.6	12.9	2.7
12/01/97	12.4	4.2	10.0	0.3	13.2	2.8	10.1	0.4	13.7	4.4	12.8	2.4
12/02/97	12.3	4.3	11.5	2.8	13.0	2.9	10.2	0.2	13.7	4.4	11.0	3.2
12/03/97	12.0	4.5	9.5	0.3	12.8	2.8	9.6	0.2	11.4	3.1	10.7	4.0
12/04/97	10.8	4.8	9.0	0.2	12.7	2.8	9.2	0.2	10.7	2.4	8.4	6.2
12/05/97	10.5	4.4	9.0	0.4	12.7	2.9	9.0	0.4	10.6	2.6	8.3	6.7
12/06/97	11.8	4.6	9.1	0.2	12.6	2.9	8.9	0.6	11.9	3.9	8.2	6.4
12/07/97	10.7	4.6	9.5	0.5	12.7	2.9	9.4	0.3	12.0	4.0	8.5	6.3
12/08/97	12.2	4.9	9.1	0.3	12.8	2.7	8.9	0.3	12.4	4.3	8.8	6.4
12/09/97	12.1	4.5	9.2	0.1	12.9	2.8	9.3	0.6	13.5	4.4	8.9	6.7
12/10/97	9.6	2.6	8.9	0.3	12.8	2.8	9.1	0.3	12.2	3.9	10.9	3.8
12/11/97	11.7	4.7	8.9	0.3	12.7	2.9	9.0	0.2	13.4	4.5	8.7	5.8
12/12/97	11.7	4.4	8.9	0.2	12.5	2.7	8.9	0.1	11.7	3.9	10.4	4.1

12/13/97	9.4	3.0	8.9	0.3	12.5	2.8	9.0	0.2	10.6	2.7	10.4	4.4
12/14/97	10.6	3.1	8.8	0.2	12.4	2.9	8.8	0.3	10.6	2.7	8.2	6.5
12/15/97	10.7	3.7	8.8	0.3	12.5	2.9	8.7	0.2	10.3	2.5	8.1	6.6
12/16/97	10.6	4.6	8.4	0.2	12.4	2.9	8.3	0.2	10.3	2.5	8.1	6.4
12/17/97	10.8	4.7	8.6	0.6	12.6	3.0	8.2	0.3	10.0	2.8	8.4	6.5
12/18/97	11.1	4.8	14.9	2.5	12.8	3.0	13.7	2.7	12.4	4.4	11.2	3.0
12/19/97	10.8	3.4	16.4	0.6	13.3	2.9	16.7	0.1	12.8	4.9	12.7	2.4
12/20/97	12.1	4.8	16.7	0.1	13.4	2.9	16.8	0.3	14.2	5.2	12.5	2.3
12/21/97	12.1	4.3	16.5	0.1	13.4	2.9	16.6	0.4	12.6	4.6	12.6	2.2
12/22/97	10.9	3.3	15.2	2.0	12.9	2.7	16.5	0.2	12.7	4.1	11.8	3.3
12/23/97	12.2	4.5	12.5	2.3	13.1	2.8	12.0	2.4	13.7	4.4	11.2	3.1
12/24/97	11.3	4.5	10.7	0.1	13.1	2.8	12.0	2.9	13.6	4.3	11.6	3.6
12/25/97	12.3	4.8	10.6	0.4	13.0	2.9	10.6	0.3	13.7	4.5	11.1	3.2
12/26/97	10.9	3.0	10.3	0.2	12.9	2.8	10.0	0.2	12.4	3.7	11.3	3.2
12/27/97	9.6	2.8	10.0	0.4	12.9	2.8	9.7	0.2	12.2	4.1	11.0	3.6
12/28/97	14.2	1.9	17.1	0.6	14.1	2.9	17.1	0.1	14.3	4.9	13.2	2.3
12/29/97	14.4	2.0	17.5	0.7	14.5	2.8	17.6	0.3	14.7	5.0	13.4	2.3
12/30/97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/31/97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01/01/98	14.2	2.1	17.3	0.1	14.1	2.6	17.6	0.3	14.8	4.7	13.9	3.0
01/02/98	14.4	2.2	18.0	0.3	14.2	2.8	17.9	0.6	14.9	4.7	13.8	2.6
01/03/98	14.7	2.3	18.3	0.3	14.5	2.9	18.3	0.4	15.3	5.1	13.7	2.3
01/04/98	14.7	2.5	17.8	0.1	14.2	2.8	16.0	2.3	14.8	4.6	13.0	2.5
01/05/98	14.7	2.3	18.1	0.8	14.4	2.8	18.2	0.1	14.7	4.7	13.7	2.3
01/06/98	16.5	1.6	20.4	0.2	15.8	3.7	20.6	0.2	15.5	4.9	14.7	2.5
01/07/98	15.7	2.6	21.1	0.2	16.1	3.8	20.8	0.3	14.8	4.0	14.8	2.5
01/08/98	16.4	1.8	20.6	0.4	16.0	3.6	21.4	0.6	14.8	3.8	14.6	2.4
01/09/98	14.9	3.0	20.1	1.6	15.8	3.7	20.6	0.3	14.3	4.3	13.8	2.8
01/10/98	14.6	3.4	19.4	2.0	15.7	3.8	20.4	0.5	13.8	3.6	13.6	3.1
01/11/98	14.7	3.7	17.3	1.5	15.6	3.7	17.3	1.9	13.3	3.8	13.3	3.1
01/12/98	14.4	3.8	16.3	0.5	15.5	3.8	15.8	0.3	12.9	3.8	13.2	3.3
01/13/98	13.8	3.9	15.6	0.7	15.2	3.8	15.6	0.6	12.3	3.3	12.7	3.7
01/14/98	14.1	4.1	14.6	0.3	14.7	3.7	15.0	0.2	11.6	2.9	12.4	3.4
01/15/98	12.8	4.1	14.0	0.2	14.7	3.8	14.1	0.5	11.3	2.9	12.3	3.5
01/16/98	12.5	4.0	13.6	0.5	14.4	3.8	13.1	0.2	11.0	2.7	12.2	3.8
01/17/98	11.9	4.2	12.5	0.3	14.7	3.9	11.9	0.5	10.4	2.3	11.7	4.0
01/18/98	12.9	0.6	13.1	0.7	14.2	3.5	13.4	0.3	11.8	3.4	13.5	2.0
01/19/98	11.2	2.6	13.3	0.8	14.5	3.8	13.7	0.5	12.5	3.5	12.5	2.9
01/20/98	13.3	3.9	13.1	0.5	14.5	3.7	12.5	0.4	10.9	2.8	12.1	3.3
01/21/98	12.9	4.1	12.4	0.3	14.1	3.5	12.7	0.5	10.2	2.4	11.9	3.6
01/22/98	12.1	3.9	11.8	0.2	14.3	3.6	11.9	0.5	10.2	2.2	11.5	3.5
01/23/98	10.5	3.2	11.5	0.3	14.2	3.8	11.6	0.6	11.3	3.2	11.6	3.7
01/24/98	11.1	3.8	11.0	0.3	12.2	5.4	10.8	0.6	9.9	1.7	11.4	3.5
01/25/98	11.2	4.7	10.0	0.3	12.0	5.4	10.3	0.1	9.2	1.2	10.9	4.0
01/26/98	11.1	4.5	9.6	0.4	12.0	5.2	9.7	0.4	9.2	1.5	10.8	4.0
01/27/98	10.7	3.8	9.1	0.5	11.8	5.6	9.1	0.3	8.9	1.1	10.7	3.8
01/28/98	10.3	4.3	8.6	0.3	11.4	5.2	8.9	0.3	8.7	0.9	10.7	4.0

01/29/98	10.4	4.9	8.2	0.3	11.3	5.3	8.5	0.5	9.9	3.0	10.5	3.7
01/30/98	9.1	3.2	8.3	0.2	11.4	4.9	8.5	0.1	8.4	1.1	10.6	4.3
01/31/98	8.9	3.4	7.9	0.3	11.1	5.4	7.5	0.3	8.1	1.3	10.4	4.4
02/01/98	8.5	3.5	9.0	0.2	11.3	5.5	8.5	0.6	8.1	1.4	10.9	4.1
02/02/98	9.9	4.3	8.1	0.4	10.9	5.2	8.1	0.3	9.2	2.9	10.5	4.0
02/03/98	8.6	3.4	7.7	0.4	10.9	5.2	7.7	0.3	7.6	1.5	10.3	3.9
02/04/98	9.9	4.1	7.3	0.1	10.8	5.1	7.6	0.3	7.7	1.1	10.3	4.0
02/05/98	8.2	3.3	7.3	0.5	10.7	5.3	7.5	0.1	9.2	2.9	10.3	4.1
02/06/98	8.5	3.0	7.3	0.2	10.5	5.0	7.2	0.3	9.1	2.8	10.3	4.1
02/07/98	8.4	3.5	7.2	0.4	10.6	5.0	7.4	0.2	7.0	1.9	10.3	4.5
02/08/98	8.1	3.5	7.2	0.5	10.6	5.1	6.8	0.1	9.1	2.6	10.0	4.4
02/09/98	8.5	3.6	6.8	0.5	10.5	4.7	6.5	0.5	9.3	3.0	8.0	6.6
02/10/98	8.5	3.2	6.6	0.3	10.5	5.1	6.7	0.3	9.4	3.2	8.2	6.3
02/11/98	8.9	3.8	6.7	0.4	10.3	4.8	6.4	0.2	6.8	1.8	10.2	4.3
02/12/98	7.9	3.5	6.4	0.3	10.2	4.8	6.6	0.4	7.3	1.9	8.1	6.1
02/13/98	8.2	3.7	6.5	0.4	10.1	4.9	6.2	0.3	6.8	1.5	7.9	6.4
02/14/98	8.0	3.7	6.3	0.0	10.1	5.0	6.5	0.4	6.6	1.8	8.2	6.2
02/15/98	6.6	2.2	6.1	0.2	10.1	4.5	6.6	0.3	6.9	1.8	8.0	6.3
02/16/98	8.0	3.5	6.1	0.5	9.9	5.0	6.5	0.2	11.1	5.2	7.9	6.5
02/17/98												
02/18/98	7.7	3.5	6.2	0.3	9.9	4.9	6.1	0.4	10.6	6.5	7.7	6.2
02/19/98	7.5	3.5	6.0	0.3	9.8	4.9	6.1	0.2	12.4	10.2	7.7	6.3
02/20/98	6.1	2.3	5.9	0.3	9.0	5.3	6.0	0.1	10.6	6.7	7.6	6.5
02/21/98	7.5	3.4	5.8	0.3	8.9	4.6	5.7	0.1	12.0	9.0	7.8	6.1
02/22/98	7.2	3.7	5.3	0.4	8.6	4.5	5.6	0.4	13.0	12.5	7.6	6.2
02/23/98	5.4	2.0	5.7	0.1	8.2	5.1	5.4	0.2	12.0	9.2	7.3	6.5
02/24/98	5.8	1.3	5.6	0.1	8.5	5.4	5.7	0.1	11.0	9.0	7.3	6.5
02/25/98	7.0	3.4	5.9	0.2	8.5	5.3	5.7	0.1	10.9	8.3	7.6	6.4
02/26/98	6.1	2.3	5.6	0.2	9.7	5.2	5.7	0.4	10.9	7.3	7.7	6.7
02/27/98	7.1	3.7	5.8	0.2	8.4	5.1	5.8	0.1	10.7	8.7	8.0	6.4
02/28/98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/01/98	6.9	3.7	5.8	0.3	8.2	5.4	5.7	0.2	11.3	9.6	6.5	4.9
03/02/98	5.2	2.0	5.3	0.2	8.5	4.6	5.7	0.3	11.5	9.4	7.5	6.3
03/03/98	7.0	3.4	5.8	0.1	9.4	5.1	5.5	0.1	10.9	8.4	7.6	6.8
03/04/98	6.9	3.7	5.9	0.4	9.4	4.8	6.0	0.1	5.1	3.5	7.6	6.5
03/05/98	7.2	3.6	6.2	0.3	9.6	4.4	6.1	0.2	9.6	5.0	7.9	6.1
03/06/98	5.3	2.3	5.8	0.3	9.4	5.2	6.0	0.2	5.9	4.3	7.7	6.6
03/07/98	7.1	3.6	6.0	0.1	8.2	5.1	6.0	0.2	9.9	5.2	7.6	6.1
03/08/98	5.9	3.1	5.8	0.2	9.3	4.7	6.0	0.4	10.2	7.0	6.0	4.9
03/09/98	7.3	3.4	5.6	0.1	9.2	4.9	5.5	0.1	9.9	6.8	7.4	6.6
03/10/98	5.5	1.9	5.7	0.3	8.2	5.1	5.6	0.2	5.2	3.5	7.6	6.4
03/11/98	6.0	1.8	5.8	0.2	8.1	5.1	5.9	0.1	10.7	6.7	7.8	6.6
03/12/98	7.7	3.0	5.6	0.2	8.1	5.2	5.8	0.1	11.1	9.1	7.7	6.6
03/13/98	5.4	2.0	5.5	0.1	8.1	5.2	5.6	0.1	11.8	10.2	6.0	5.2
03/14/98	7.2	3.5	5.6	0.2	8.5	4.8	5.7	0.4	11.4	10.2	6.8	5.4
03/15/98	6.7	3.8	5.6	0.4	8.2	5.4	5.5	0.2	11.6	9.3	6.8	5.3
03/16/98	7.9	4.2	5.5	0.1	8.2	5.7	5.6	0.2	11.9	11.3	6.9	5.1

03/17/98	5.4	2.6	5.3	0.2	7.9	5.4	5.2	0.4	11.3	8.5	7.7	6.6
03/18/98	4.9	1.8	5.6	0.4	8.0	5.5	5.6	0.1	10.6	7.9	6.5	5.1
03/19/98	7.0	3.4	5.5	0.3	7.8	5.6	5.5	0.5	11.1	9.6	7.7	6.3
03/20/98	7.1	3.6	5.4	0.1	8.0	5.6	5.5	0.2	13.9	10.1	6.9	5.5
03/21/98	5.2	2.6	5.5	0.1	7.7	5.5	5.3	0.2	11.3	9.9	7.4	6.8
03/22/98	6.3	3.8	5.4	0.2	7.6	5.6	5.3	0.0	11.4	10.4	7.2	6.5
03/23/98	4.6	1.7	5.0	0.3	7.4	5.7	5.0	0.2	9.9	8.6	6.1	5.0
03/24/98	4.1	1.9	5.2	0.1	7.4	5.8	5.0	0.2	10.4	9.0	5.8	4.8
03/25/98	4.0	1.4	5.0	0.3	7.4	5.7	5.0	0.4	9.9	8.0	5.7	4.8
03/26/98	4.6	1.8	4.9	0.1	7.6	5.7	5.2	0.2	9.6	6.8	6.9	6.5
03/27/98	4.1	1.9	5.1	0.1	7.7	5.2	5.2	0.3	3.8	2.6	6.9	6.3
03/28/98	4.5	2.6	5.0	0.1	7.3	5.4	5.0	0.1	4.5	3.3	5.5	5.0
03/29/98	4.4	2.2	5.1	0.2	7.7	5.2	5.1	0.3	4.6	3.1	7.2	6.5
03/30/98	4.8	2.1	5.2	0.3	7.6	5.5	5.2	0.1	4.3	2.9	6.8	6.4

APPENDIX N. Measured And Predicted Monthly Percolation (cm) Through Cover From MCBH Landfill Cover Demonstration Plots

	Soil A	Soil B	20%-A	20%-B	40%-A	40%-B	HELP3/RCRA
Nov-95	0.12	0.00	0.00	0.00	0.00	0.00	0.04
Dec-95	0.00	0.00	0.00	0.00	0.00	0.00	0.12
Jan-96	1.01	1.43	0.20	0.46	0.00	0.00	0.14
Feb-96	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Mar-96	0.56	0.00	0.00	0.00	0.31	0.00	0.08
Apr-96	0.00	0.00	0.00	0.00	0.00	0.00	0.03
May-96	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Jun-96	1.29	0.00	2.23	0.02	0.01	0.00	0.01
Jul-96	0.02	0.01	0.01	0.01	0.01	0.01	0.00
Aug-96	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Sep-96	0.01	0.00	0.00	0.00	0.00	0.01	0.00
Oct-96	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Nov-96	8.02	0.47	3.71	0.24	0.49	2.39	0.04
Dec-96	0.06	0.00	0.00	0.00	0.35	0.00	0.12
Jan-97	2.01	0.89	0.25	0.23	0.21	0.24	0.14
Feb-97	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Mar-97	0.10	0.00	0.00	0.00	0.20	0.00	0.08
Apr-97	0.21	0.14	0.00	0.00	0.20	0.00	0.03
May-97	0.83	0.00	0.00	0.00	0.07	0.00	0.01
Jun-97	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Jul-97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug-97	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Sep-97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct-97	0.00	0.00	0.00	0.00	0.00	0.05	0.01
Nov-97	0.06	0.11	0.12	0.07	0.05	0.04	0.04
Dec-97	0.00	0.00	0.00	0.00	0.00	0.00	0.12
Jan-98	0.00	0.00	0.00	0.00	0.01	0.00	0.14
Feb-98	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Mar-98	0.00	0.00	0.00	0.00	0.01	0.00	
Sum	14.31	3.07	6.53	1.04	1.91	2.74	1.60

APPENDIX O. Plot Pair Average Percolation (cm) From MCBH Plots

	SOIL	20%	40%	HELP3/RCRA
Nov-95	0.06	0.00	0.00	0.04
Dec-95	0.00	0.00	0.00	0.12
Jan-96	1.22	0.33	0.00	0.14
Feb-96	0.00	0.00	0.00	0.13
Mar-96	0.28	0.00	0.16	0.08
Apr-96	0.00	0.00	0.00	0.03
May-96	0.00	0.00	0.00	0.01
Jun-96	0.65	1.13	0.01	0.01
Jul-96	0.02	0.01	0.01	0.00
Aug-96	0.00	0.00	0.00	0.01
Sep-96	0.01	0.00	0.01	0.00
Oct-96	0.00	0.00	0.00	0.01
Nov-96	4.24	1.98	1.44	0.04
Dec-96	0.03	0.00	0.17	0.12
Jan-97	1.45	0.24	0.22	0.14
Feb-97	0.00	0.00	0.00	0.13
Mar-97	0.05	0.00	0.10	0.08
Apr-97	0.17	0.00	0.10	0.03
May-97	0.42	0.00	0.03	0.01
Jun-97	0.00	0.00	0.00	0.01
Jul-97	0.00	0.00	0.00	0.00
Aug-97	0.00	0.00	0.00	0.01
Sep-97	0.00	0.00	0.00	0.00
Oct-97	0.00	0.00	0.03	0.01
Nov-97	0.08	0.09	0.05	0.04
Dec-97	0.00	0.00	0.00	0.12
Jan-98	0.00	0.00	0.01	0.14
Feb-98	0.00	0.00	0.00	0.13
Mar-98	0.00	0.00	0.01	0.08
SUM	8.69	3.78	2.34	1.68

APPENDIX P. Mean Relative Monthly Percolation (% of precipitation) From MCBH Plots

	SOIL	20%	40%	HELP3/RCRA
Nov-95	0.06	0.00	0.00	0.04
Dec-95	0.00	0.00	0.00	0.12
Jan-96	1.22	0.33	0.00	0.14
Feb-96	0.00	0.00	0.00	0.13
Mar-96	0.28	0.00	0.16	0.08
Apr-96	0.00	0.00	0.00	0.03
May-96	0.00	0.00	0.00	0.01
Jun-96	0.65	1.13	0.01	0.01
Jul-96	0.02	0.01	0.01	0.00
Aug-96	0.00	0.00	0.00	0.01
Sep-96	0.01	0.00	0.01	0.00
Oct-96	0.00	0.00	0.00	0.01
Nov-96	4.24	1.98	1.44	0.04
Dec-96	0.03	0.00	0.17	0.12
Jan-97	1.45	0.24	0.22	0.14
Feb-97	0.00	0.00	0.00	0.13
Mar-97	0.05	0.00	0.10	0.08
Apr-97	0.17	0.00	0.10	0.03
May-97	0.42	0.00	0.03	0.01
Jun-97	0.00	0.00	0.00	0.01
Jul-97	0.00	0.00	0.00	0.00
Aug-97	0.00	0.00	0.00	0.01
Sep-97	0.00	0.00	0.00	0.00
Oct-97	0.00	0.00	0.03	0.01
Nov-97	0.08	0.09	0.05	0.04
Dec-97	0.00	0.00	0.00	0.12
Jan-98	0.00	0.00	0.01	0.14
Feb-98	0.00	0.00	0.00	0.13
Mar-98	0.00	0.00	0.01	0.08
SUM	8.69	3.78	2.34	1.68

APPENDIX Q. Daily, weekly, and monthly water balance for soil plots at MCBH

DAILY WATER BALANCE ON SOIL PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
07/19/96	0.03	10.87		0.00	0.00	0.03
07/20/96	0.00	10.33	-0.54	0.00	0.00	0.54
07/21/96	0.00	8.75	-1.58	0.00	0.00	1.58
07/22/96	0.36	9.70	0.96	0.00	0.00	0.00
07/23/96	0.00	10.43	0.73	0.00	0.00	0.00
07/24/96	0.00	8.44	-1.99	0.00	0.00	1.99
07/25/96	0.00			0.00	0.00	0.00
07/26/96	0.00	9.76	1.32	0.00	0.00	0.00
07/27/96	0.18			0.00	0.00	0.18
07/28/96	0.00			0.00	0.00	0.00
07/29/96	0.00	10.55	0.78	0.00	0.00	0.00
07/30/96	0.00	9.66	-0.89	0.00	0.00	0.89
07/31/96				0.00	0.00	0.00
08/01/96	0.04	7.79	-1.87	0.00	0.00	1.91
08/02/96	0.00	8.84	1.05	0.00	0.00	0.00
08/03/96	0.00	8.59	-0.25	0.00	0.00	0.25
08/04/96	0.03	7.59	-1.00	0.00	0.00	1.02
08/05/96	0.00	7.35	-0.24	0.00	0.00	0.24
08/06/96	0.04	7.82	0.47	0.00	0.00	0.00
08/07/96	0.01	7.10	-0.72	0.00	0.00	0.73
08/08/96	0.00	7.26	0.16	0.00	0.00	0.00
08/09/96	0.09	7.00	-0.26	0.00	0.00	0.35
08/10/96	0.05	6.93	-0.08	0.00	0.00	0.13
08/11/96	0.56			0.00	0.00	0.56
08/12/96	0.00			0.00	0.00	0.00
08/13/96	0.33	8.07	1.14	0.00	0.00	0.00
08/14/96	0.00	6.51	-1.56	0.00	0.00	1.56
08/15/96	0.00	8.04	1.53	0.00	0.00	0.00
08/16/96				0.00	0.00	0.00
08/17/96				0.00	0.00	0.00
08/18/96				0.00	0.00	0.00
08/19/96				0.00	0.00	0.00
08/20/96				0.00	0.00	0.00
08/21/96				0.00	0.00	0.00
08/22/96				0.00	0.00	0.00
08/23/96				0.00	0.00	0.00
08/24/96				0.00	0.00	0.00
08/25/96				0.00	0.00	0.00
08/26/96	0.00	6.12	-1.92	0.00	0.00	1.92
08/27/96	0.05	7.00	0.88	0.00	0.00	0.00
08/28/96	0.00			0.00	0.00	0.00
08/29/96	0.00	6.85	-0.14	0.00	0.00	0.14
08/30/96	0.14	6.60	-0.26	0.00	0.00	0.40

08/31/96	2.03	9.00	2.40	0.00	0.00	0.00
09/01/96	0.00	14.06	5.06	0.00	0.00	0.00
09/02/96	0.00	13.68	-0.38	0.00	0.00	0.38
09/03/96	0.00	13.50	-0.18	0.00	0.00	0.18
09/04/96	0.30	13.58	0.08	0.00	0.00	0.22
09/05/96	0.71	13.70	0.13	0.00	0.00	0.58
09/06/96	0.46	13.01	-0.69	0.00	0.00	1.15
09/07/96	0.20			0.00	0.00	0.20
09/08/96	0.43	13.24	0.22	0.00	0.00	0.21
09/09/96	0.00			0.00	0.00	0.00
09/10/96	0.01	13.01	-0.23	0.00	0.00	0.24
09/11/96	0.25			0.00	0.00	0.25
09/12/96	0.05			0.00	0.00	0.05
09/13/96	0.00	11.46	-1.56	0.00	0.00	1.56
09/14/96	0.00	10.52	-0.94	0.00	0.00	0.94
09/15/96	0.08	10.09	-0.43	0.00	0.00	0.50
09/16/96	0.00	10.07	-0.01	0.00	0.00	0.01
09/17/96	0.00	9.93	-0.14	0.00	0.00	0.14
09/18/96	0.00	9.75	-0.18	0.00	0.00	0.18
09/19/96	0.19	9.40	-0.35	0.00	0.00	0.54
09/20/96	0.13	9.22	-0.18	0.00	0.00	0.31
09/21/96	0.00	9.08	-0.14	0.00	0.00	0.14
09/22/96	0.00	9.04	-0.04	0.00	0.00	0.04
09/23/96	0.00	8.84	-0.20	0.00	0.00	0.20
09/24/96	0.24	9.01	0.17	0.00	0.00	0.06
09/25/96		9.06	0.05			
09/26/96		9.06	0.00			
09/27/96		7.94	-1.12			
09/28/96		7.25	-0.69			
09/29/96		7.71	0.46			
09/30/96	0.00	6.46	-1.25	0.00	0.00	1.25
10/01/96	0.00	7.16	0.70	0.00	0.00	0.00
10/02/96	0.00	6.62	-0.55	0.00	0.00	0.55
10/03/96	0.00	6.17	-0.45	0.00	0.00	0.45
10/04/96	0.00	6.46	0.29	0.00	0.00	0.00
10/05/96	0.00	6.61	0.15	0.00	0.00	0.00
10/06/96	0.00			0.00	0.00	0.00
10/07/96	0.06	6.74	0.12	0.00	0.00	0.00
10/08/96	0.00	6.06	-0.67	0.00	0.00	0.67
10/09/96	0.00	6.80	0.73	0.00	0.00	0.00
10/10/96	0.05	6.91	0.11	0.00	0.00	0.00
10/11/96	0.00	5.91	-1.01	0.00	0.00	1.01
10/12/96	0.00	5.54	-0.36	0.00	0.00	0.36
10/13/96	0.00	6.06	0.52	0.00	0.00	0.00
10/14/96	0.04	6.28	0.22	0.00	0.00	0.00
10/15/96	0.17	6.06	-0.22	0.00	0.00	0.38
10/16/96	0.11	6.58	0.51	0.00	0.00	0.00

10/17/96	0.00	6.16	-0.42	0.00	0.00	0.42
10/18/96	0.00	6.33	0.17	0.00	0.00	0.00
10/19/96	0.41	5.36	-0.97	0.00	0.00	1.38
10/20/96	0.14	5.43	0.08	0.00	0.00	0.06
10/21/96	0.00	6.32	0.88	0.00	0.00	0.00
10/22/96	0.00	5.33	-0.99	0.00	0.00	0.99
10/23/96	0.01	5.87	0.54	0.00	0.00	0.00
10/24/96	0.00	5.83	-0.03	0.00	0.00	0.03
10/25/96	0.00	7.35	1.52	0.00	0.00	0.00
10/26/96	0.00	5.87	-1.48	0.00	0.00	1.48
10/27/96	0.00	6.88	1.01	0.00	0.00	0.00
10/28/96	0.00	6.02	-0.87	0.00	0.00	0.87
10/29/96	0.03	6.95	0.93	0.00	0.00	0.00
10/30/96	0.00	7.07	0.12	0.00	0.00	0.00
10/31/96	0.00			0.00	0.00	0.00
11/01/96	0.00	5.97	-1.09	0.00	0.00	1.09
11/02/96	0.27	5.87	-0.11	0.00	0.00	0.37
11/03/96	0.00	6.68	0.82	0.00	0.00	0.00
11/04/96	0.00	5.51	-1.17	0.00	0.00	1.17
11/05/96	11.91	5.33	-0.19	0.24	0.40	11.46
11/06/96	0.05	15.03	9.70	0.00	0.02	0.00
11/07/96	0.06	23.62	8.60	0.00	0.00	0.00
11/08/96	3.39	25.30	1.68	0.27	0.00	1.45
11/09/96	0.00	25.17	-0.14	0.00	0.01	0.12
11/10/96	0.01	24.21	-0.95	0.00	0.01	0.95
11/11/96	0.01	24.03	-0.18	0.00	0.00	0.19
11/12/96	5.65	23.31	-0.72	0.00	0.00	6.37
11/13/96	2.81	23.86	0.55	0.36	0.39	1.51
11/14/96	5.54	24.71	0.85	0.97	1.42	2.30
11/15/96	1.68	25.02	0.31	0.00	0.11	1.26
11/16/96	5.79			1.29	1.46	3.04
11/17/96	1.12	24.38	-0.64	0.13	0.23	1.40
11/18/96	0.11	25.21	0.83	0.00	0.16	0.00
11/19/96	0.00					0.00
11/20/96	0.00			0.00	0.00	0.00
11/21/96	0.00	24.13	-1.08	0.00	0.00	1.08
11/22/96	0.01	24.61	0.47	0.00	0.00	0.00
11/23/96	0.00	24.44	-0.17	0.00	0.01	0.16
11/24/96	0.04	24.25	-0.18	0.00	0.00	0.22
11/25/96	0.00			0.00	0.00	0.00
11/26/96	0.00	24.08	-0.17	0.00	0.02	0.15
11/27/96	0.00	24.42	0.34	0.01	0.00	0.00
11/28/96	0.03	23.89	-0.53	0.00	0.00	0.56
11/29/96	0.00	22.44	-1.45	0.00	0.00	1.45
11/30/96	0.00	23.43	0.99	0.00	0.00	0.00
12/01/96	0.00	22.02	-1.41	0.00	0.00	1.41
12/02/96	0.00	21.98	-0.03	0.00	0.00	0.03

12/03/96	0.28			0.00	0.00	0.28
12/04/96	0.05	21.24	-0.74	0.00	0.00	0.79
12/05/96	0.09	20.26	-0.98	0.00	0.00	1.07
12/06/96	0.01	20.61	0.35	0.00	0.00	0.00
12/07/96	0.43	20.77	0.16	0.00	0.00	0.27
12/08/96	0.04	20.31	-0.47	0.00	0.00	0.50
12/09/96	0.00			0.00	0.00	0.00
12/10/96	0.09	19.32	-0.98	0.00	0.00	1.07
12/11/96	0.32	19.34	0.01	0.00	0.00	0.30
12/12/96	0.05	19.06	-0.28	0.00	0.00	0.33
12/13/96	0.10	18.91	-0.15	0.01	0.00	0.25
12/14/96	0.74			0.00	0.00	0.74
12/15/96	0.03			0.00	0.00	0.03
12/16/96	0.00	21.38	2.47	0.00	0.00	0.00
12/17/96	0.00			0.00	0.00	0.00
12/18/96	0.00	19.38	-2.00	0.00	0.00	2.00
12/19/96	0.00	19.31	-0.07	0.00	0.00	0.06
12/20/96	0.00	19.15	-0.16	0.00	0.00	0.16
12/21/96	0.17			0.00	0.00	0.17
12/22/96	0.25	19.71	0.55	0.00	0.00	0.00
12/23/96	0.47	20.98	1.28	0.00	0.00	0.00
12/24/96	0.20	19.47	-1.52	0.01	0.00	1.71
12/25/96	0.00			0.00	0.00	0.00
12/26/96	0.34	21.62	2.16	0.00	0.03	0.00
12/27/96	1.03	24.33	2.71	0.04	0.00	0.00
12/28/96	0.43			0.00	0.00	0.43
12/29/96	0.00	22.75	-1.59	0.00	0.00	1.59
12/30/96	0.04			0.00	0.00	0.04
12/31/96	0.48	23.22	0.48	0.00	0.00	0.00
01/01/97	0.33			0.00	0.00	0.33
01/02/97	0.00			0.00	0.00	0.00
01/03/97	0.18	23.70	0.47	0.57	1.03	0.00
01/04/97	3.06	24.91	1.21	0.00	0.17	1.67
01/05/97	0.24	24.41	-0.50	0.00	0.05	0.69
01/06/97	0.15			0.00	0.00	0.15
01/07/97	0.13	23.18	-1.23	0.00	0.00	1.36
01/08/97	0.14	23.22	0.04	0.00	0.04	0.06
01/09/97	0.15	23.00	-0.21	0.00	0.00	0.36
01/10/97	0.20	24.10	1.09	0.00	0.03	0.00
01/11/97	0.23			0.00	0.00	0.23
01/12/97		23.89	-0.20			0.20
01/13/97		22.69	-1.20			1.20
01/14/97		23.52	0.83			0.00
01/15/97		23.53	0.01			0.00
01/16/97		23.87	0.34			0.00
01/17/97	0.00	23.44	-0.43	0.00	0.00	0.43
01/18/97	0.00	23.19	-0.25	0.00	0.00	0.25

01/19/97	5.51	23.08	-0.11	1.31	0.00	4.32
01/20/97	0.06	24.14	1.07	0.00	0.07	0.00
01/21/97	1.08	24.06	-0.09	0.03	0.03	1.11
01/22/97	0.00	24.08	0.03	0.00	0.03	0.00
01/23/97	0.00	23.60	-0.48	0.00	0.00	0.48
01/24/97	0.00	23.49	-0.11	0.00	0.00	0.11
01/25/97	0.00	23.29	-0.20	0.00	0.00	0.20
01/26/97	0.00	23.27	-0.02	0.00	0.00	0.02
01/27/97	0.00	23.18	-0.09	0.00	0.00	0.09
01/28/97	0.04	23.32	0.14	0.00	0.00	0.00
01/29/97	0.89	23.17	-0.15	0.00	0.00	1.04
01/30/97	0.11	23.78	0.61	0.00	0.00	0.00
01/31/97	0.10	23.95	0.17	0.00	0.00	0.00
02/01/97	0.00	23.84	-0.11	0.00	0.00	0.11
02/02/97	0.05	23.70	-0.14	0.00	0.00	0.19
02/03/97	0.00			0.00	0.00	0.00
02/04/97	0.00			0.00	0.00	0.00
02/05/97	0.00	23.26	-0.44	0.00	0.00	0.44
02/06/97	0.00	22.45	-0.81	0.00	0.00	0.81
02/07/97	0.00	22.14	-0.31	0.00	0.00	0.31
02/08/97	0.00	21.68	-0.47	0.00	0.00	0.47
02/09/97	0.00	21.53	-0.15	0.00	0.00	0.15
02/10/97	0.03	20.69	-0.84	0.00	0.00	0.86
02/11/97	0.00	20.67	-0.02	0.00	0.00	0.02
02/12/97	0.00	19.54	-1.13	0.00	0.00	1.13
02/13/97	0.00	17.85	-1.69	0.00	0.00	1.69
02/14/97	0.00	17.10	-0.75	0.00	0.00	0.75
02/15/97	0.00			0.00	0.00	0.00
02/16/97	0.00	16.09	-1.01	0.00	0.00	1.01
02/17/97	0.00	15.62	-0.47	0.00	0.00	0.47
02/18/97	0.00	15.50	-0.11	0.00	0.00	0.11
02/19/97	0.00	14.90	-0.60	0.00	0.00	0.60
02/20/97	0.00	15.14	0.23	0.00	0.00	0.00
02/21/97	0.24	14.36	-0.78	0.00	0.00	1.02
02/22/97	0.38	14.08	-0.27	0.00	0.00	0.66
02/23/97	0.04	14.23	0.15	0.00	0.00	0.00
02/24/97	0.00	14.67	0.43	0.00	0.00	0.00
02/25/97	0.18	14.66	-0.01	0.00	0.00	0.18
02/26/97	0.28	14.08	-0.58	0.00	0.00	0.86
02/27/97	0.08	13.88	-0.20	0.00	0.00	0.28
02/28/97	0.03	14.16	0.28	0.00	0.00	0.00
03/01/97	0.15			0.00	0.00	0.15
03/02/97	0.06	14.65	0.49	0.00	0.00	0.00
03/03/97	0.00	14.36	-0.29	0.00	0.00	0.29
03/04/97	0.28	13.17	-1.19	0.00	0.00	1.47
03/05/97	0.28	14.22	1.05	0.00	0.00	0.00
03/06/97	0.08	14.30	0.08	0.00	0.00	0.00

03/07/97	0.01	14.35	0.06	0.00	0.00	0.00
03/08/97	0.00	13.48	-0.87	0.00	0.00	0.87
03/09/97	0.04	12.90	-0.58	0.00	0.00	0.62
03/10/97	0.01	13.50	0.60	0.00	0.00	0.00
03/11/97	0.36	18.35	4.85	0.05	0.00	0.00
03/12/97	0.06	19.33	0.98	0.00	0.00	0.00
03/13/97	0.03	20.16	0.82	0.00	0.00	0.00
03/14/97	0.05	20.70	0.54	0.00	0.00	0.00
03/15/97	0.04	20.85	0.15	0.00	0.00	0.00
03/16/97	0.01	20.94	0.08	0.00	0.00	0.00
03/17/97	0.01	24.59	3.66	0.41	0.03	0.00
03/18/97	0.04	23.26	-1.34	0.00	0.00	1.37
03/19/97	0.04	22.87	-0.38	0.00	0.00	0.42
03/20/97	0.01	22.37	-0.51	0.00	0.00	0.52
03/21/97	0.01	22.12	-0.24	0.00	0.00	0.26
03/22/97	0.01	21.69	-0.43	0.00	0.00	0.45
03/23/97	0.01	24.16	2.47	0.00	0.00	0.00
03/24/97	0.01			0.00	0.02	0.00
03/25/97	1.22			0.00	0.00	1.22
03/26/97	0.01	23.84	-0.32	0.00	0.00	0.33
03/27/97	0.15	23.60	-0.24	0.00	0.00	0.39
03/28/97	0.04	23.32	-0.28	0.00	0.00	0.31
03/29/97	0.00	22.84	-0.49	0.00	0.00	0.49
03/30/97	0.00	21.71	-1.13	0.00	0.00	1.13
03/31/97	1.87	19.94	-1.77	0.00	0.00	3.64
04/01/97	3.07	25.00	5.06	0.05	0.07	0.00
04/02/97	1.24	24.62	-0.38	0.12	0.33	1.17
04/03/97	0.00	24.12	-0.50	0.00	0.00	0.50
04/04/97	0.47	23.84	-0.28	0.00	0.00	0.75
04/05/97	0.03	23.64	-0.20	0.00	0.00	0.22
04/06/97	0.00	23.48	-0.16	0.00	0.00	0.16
04/07/97	0.04	23.07	-0.41	0.00	0.00	0.44
04/08/97	0.00	22.31	-0.76	0.00	0.00	0.76
04/09/97	0.08	22.05	-0.26	0.00	0.00	0.34
04/10/97	0.03	20.20	-1.84	0.00	0.00	1.87
04/11/97	0.00	19.19	-1.01	0.00	0.00	1.01
04/12/97	0.00	18.72	-0.47	0.00	0.00	0.47
04/13/97	0.00	18.37	-0.36	0.00	0.00	0.36
04/14/97	0.00	17.65	-0.72	0.00	0.00	0.72
04/15/97	0.00	17.26	-0.39	0.00	0.00	0.39
04/16/97	0.00	16.59	-0.66	0.00	0.00	0.66
04/17/97	0.00	16.08	-0.51	0.00	0.00	0.51
04/18/97	0.00	15.63	-0.45	0.00	0.00	0.45
04/19/97	0.00	15.53	-0.10	0.00	0.00	0.10
04/20/97	0.00	14.77	-0.76	0.00	0.00	0.76
04/21/97	0.00	14.72	-0.04	0.00	0.00	0.04
04/22/97	0.00	14.80	0.07	0.00	0.00	0.00

04/23/97	0.00			0.00	0.00	0.00
04/24/97	0.00			0.00	0.00	0.00
04/25/97	0.00			0.00	0.00	0.00
04/26/97	0.00			0.00	0.00	0.00
04/27/97	0.04	13.74	-1.06	0.00	0.00	1.10
04/28/97	0.03	13.49	-0.24	0.00	0.00	0.27
04/29/97	0.00	13.51	0.02	0.00	0.00	0.00
04/30/97	0.00	12.91	-0.60	0.00	0.00	0.60
05/01/97	0.00	12.70	-0.21	0.00	0.00	0.21
05/02/97	0.04	12.54	-0.16	0.00	0.00	0.20
05/03/97	0.00	12.97	0.44	0.00	0.00	0.00
05/04/97	0.20	12.62	-0.35	0.00	0.00	0.56
05/05/97	1.64	12.61	-0.01	0.00	0.03	1.61
05/06/97	0.99	21.44	8.83	0.22	0.38	0.00
05/07/97	0.14	21.66	0.22	0.00	0.00	0.00
05/08/97	0.01	21.74	0.08	0.00	0.00	0.00
05/09/97	0.01	21.61	-0.13	0.00	0.00	0.14
05/10/97	0.23	21.19	-0.42	0.00	0.00	0.65
05/11/97	0.00	21.19	0.00	0.00	0.00	0.00
05/12/97	0.01	21.06	-0.12	0.00	0.00	0.13
05/13/97	0.32	21.22	0.15	0.00	0.00	0.16
05/14/97	0.04	21.05	-0.16	0.00	0.00	0.20
05/15/97	0.43	21.34	0.29	0.00	0.00	0.14
05/16/97	0.10	21.55	0.21	0.00	0.00	0.00
05/17/97	0.00	20.98	-0.58	0.00	0.00	0.58
05/18/97	0.01	20.55	-0.42	0.00	0.00	0.44
05/19/97	0.00	20.32	-0.23	0.00	0.00	0.23
05/20/97	0.00	19.59	-0.73	0.00	0.00	0.73
05/21/97	0.20	19.06	-0.53	0.00	0.00	0.73
05/22/97	0.06	19.66	0.60	0.00	0.00	0.00
05/23/97	0.01	18.60	-1.07	0.00	0.00	1.08
05/24/97	0.00	18.28	-0.32	0.00	0.00	0.32
05/25/97	0.00	17.88	-0.40	0.00	0.00	0.40
05/26/97	0.00	17.09	-0.79	0.05	0.00	0.74
05/27/97	0.00			0.00	0.00	0.00
05/28/97						0.00
05/29/97		13.84	-3.25			3.25
05/30/97		13.06	-0.78			0.78
05/31/97		12.97	-0.09			0.09
06/01/97		13.56	0.59			0.00
06/02/97	0.00	12.82	-0.74	0.00	0.00	0.74
06/03/97	0.37	14.15	1.33	0.00	0.00	0.00
06/04/97	0.14	12.75	-1.40	0.00	0.00	1.54

06/05/97	0.01	12.91	0.16	0.00	0.00	0.00
06/06/97	0.00	12.47	-0.44	0.00	0.00	0.44
06/07/97	0.01	12.44	-0.03	0.00	0.00	0.04
06/08/97	0.00	12.01	-0.43	0.00	0.00	0.43
06/09/97	0.01	11.52	-0.50	0.00	0.00	0.51
06/10/97	0.36	11.13	-0.39	0.00	0.00	0.74
06/11/97	0.05	10.89	-0.24	0.00	0.00	0.29
06/12/97	0.04	11.73	0.84	0.00	0.00	0.00
06/13/97	0.01	11.11	-0.62	0.00	0.00	0.63
06/14/97	0.10	11.56	0.44	0.00	0.00	0.00
06/15/97	0.00	10.72	-0.83	0.00	0.00	0.83
06/16/97	0.04	10.79	0.07	0.00	0.00	0.00
06/17/97	0.13	11.14	0.35	0.00	0.00	0.00
06/18/97	0.00	10.42	-0.72	0.00	0.00	0.72
06/19/97	0.00	10.00	-0.42	0.00	0.00	0.42
06/20/97	0.22	9.84	-0.16	0.00	0.00	0.38
06/21/97	0.00	9.90	0.06	0.00	0.00	0.00
06/22/97	0.14	10.18	0.28	0.00	0.00	0.00
06/23/97	0.09	9.52	-0.65	0.00	0.00	0.74
06/24/97	0.00	9.99	0.46	0.00	0.00	0.00
06/25/97	0.14			0.00	0.00	0.14
06/26/97	0.00	8.67	-1.31	0.00	0.00	1.31
06/27/97	0.09	8.44	-0.24	0.00	0.00	0.32
06/28/97	0.30	8.75	0.31	0.00	0.00	0.00
06/29/97	0.00	8.03	-0.72	0.00	0.00	0.72
06/30/97	0.04	8.23	0.20	0.00	0.00	0.00
07/01/97	0.08	7.90	-0.33	0.00	0.00	0.40
07/02/97	0.00	8.28	0.38	0.00	0.00	0.00
07/03/97	0.11	8.06	-0.22	0.00	0.00	0.33
07/04/97	0.00	8.17	0.11	0.00	0.00	0.00
07/05/97	0.04	7.98	-0.19	0.00	0.00	0.23
07/06/97	0.09	7.92	-0.06	0.00	0.00	0.14
07/07/97	0.05	7.56	-0.36	0.00	0.00	0.41
07/08/97	0.43	7.47	-0.09	0.00	0.00	0.52
07/09/97	0.04	7.50	0.03	0.00	0.00	0.01
07/10/97	0.06	7.40	-0.09	0.00	0.00	0.16
07/11/97	0.03	7.45	0.05	0.00	0.00	0.00
07/12/97	0.09	7.44	-0.01	0.00	0.00	0.10
07/13/97	0.00	7.51	0.07	0.00	0.00	0.00
07/14/97	0.03	7.31	-0.20	0.00	0.00	0.23
07/15/97	0.04	7.49	0.18	0.00	0.00	0.00
07/16/97	0.06	7.27	-0.22	0.00	0.00	0.28
07/17/97	0.00	7.29	0.03	0.00	0.00	0.00
07/18/97	0.00	7.20	-0.09	0.00	0.00	0.09
07/19/97	0.00	7.35	0.15	0.00	0.00	0.00
07/20/97	0.17	7.10	-0.26	0.00	0.00	0.42
07/21/97	1.75	11.24	4.14	0.00	0.00	0.00

07/22/97	0.00	11.14	-0.10	0.00	0.00	0.10
07/23/97	0.00	10.66	-0.48	0.00	0.00	0.48
07/24/97	0.13	10.73	0.07	0.00	0.00	0.05
07/25/97	0.00	10.45	-0.28	0.00	0.00	0.28
07/26/97	0.03	10.48	0.03	0.00	0.00	0.00
07/27/97	0.00	10.40	-0.08	0.00	0.00	0.08
07/28/97	0.10	10.26	-0.15	0.00	0.00	0.25
07/29/97	0.67	11.90	1.64	0.00	0.00	0.00
07/30/97	0.06	11.53	-0.37	0.00	0.00	0.43
07/31/97	0.05	10.86	-0.67	0.00	0.00	0.72
08/01/97	0.01	10.84	-0.01	0.00	0.00	0.03
08/02/97	0.00	10.74	-0.10	0.00	0.00	0.10
08/03/97	0.00	10.64	-0.10	0.00	0.00	0.10
08/04/97	0.00	10.04	-0.60	0.00	0.00	0.60
08/05/97	0.00	9.89	-0.15	0.00	0.00	0.15
08/06/97	0.00	9.04	-0.85	0.00	0.00	0.85
08/07/97	0.03	9.23	0.19	0.00	0.00	0.00
08/08/97	0.00	8.71	-0.52	0.00	0.00	0.52
08/09/97	0.03	8.06	-0.66	0.00	0.00	0.68
08/10/97	0.03	7.95	-0.11	0.00	0.00	0.14
08/11/97	0.00	7.54	-0.40	0.00	0.00	0.40
08/12/97	0.00	8.18	0.64	0.00	0.00	0.00
08/13/97	0.00	7.38	-0.81	0.00	0.00	0.81
08/14/97	0.00	8.15	0.78	0.00	0.00	0.00
08/15/97	0.09	7.15	-1.00	0.00	0.00	1.09
08/16/97	0.37	7.10	-0.06	0.00	0.00	0.43
08/17/97	0.03	7.02	-0.07	0.00	0.00	0.10
08/18/97	0.00	7.12	0.10	0.00	0.00	0.00
08/19/97	0.05	6.81	-0.32	0.00	0.00	0.37
08/20/97	0.01	7.89	1.09	0.00	0.00	0.00
08/21/97	0.08	7.05	-0.84	0.00	0.00	0.92
08/22/97	0.00	6.93	-0.12	0.00	0.00	0.12
08/23/97	0.00	7.03	0.09	0.00	0.00	0.00
08/24/97	0.00	7.09	0.07	0.00	0.00	0.00
08/25/97	0.01	6.84	-0.26	0.00	0.00	0.27
08/26/97	0.00	6.87	0.03	0.00	0.00	0.00
08/27/97	0.14	7.48	0.61	0.00	0.00	0.00
08/28/97	0.01	6.65	-0.83	0.00	0.00	0.85
08/29/97	0.00	6.69	0.04	0.00	0.00	0.00
08/30/97	0.17	6.72	0.02	0.00	0.00	0.14
08/31/97	0.00	6.74	0.02	0.00	0.00	0.00
09/01/97	0.00	6.72	-0.01	0.00	0.00	0.01
09/02/97	0.00	6.85	0.13	0.00	0.00	0.00
09/03/97	0.00	6.78	-0.07	0.00	0.00	0.07
09/04/97	0.00	6.47	-0.31	0.00	0.00	0.31
09/05/97	0.00	6.65	0.17	0.00	0.00	0.00
09/06/97	0.00	6.35	-0.29	0.00	0.00	0.29

09/07/97	0.01	6.14	-0.21	0.00	0.00	0.22
09/08/97	0.00	6.25	0.10	0.00	0.00	0.00
09/09/97	0.00	6.34	0.09	0.00	0.00	0.00
09/10/97	0.04	6.25	-0.09	0.00	0.00	0.13
09/11/97	0.13	6.37	0.12	0.00	0.00	0.01
09/12/97	0.01	6.18	-0.19	0.00	0.00	0.20
09/13/97	0.04	6.11	-0.07	0.00	0.00	0.11
09/14/97	0.00	6.28	0.17	0.00	0.00	0.00
09/15/97	0.09	6.11	-0.17	0.00	0.00	0.26
09/16/97	0.03	6.15	0.03	0.00	0.00	0.00
09/17/97	0.01	5.93	-0.21	0.00	0.00	0.23
09/18/97	0.20	5.65	-0.28	0.00	0.00	0.49
09/19/97	0.05	6.18	0.53	0.00	0.00	0.00
09/20/97	0.09	5.95	-0.23	0.00	0.00	0.32
09/21/97	0.00	6.01	0.07	0.00	0.00	0.00
09/22/97	0.00	5.98	-0.03	0.00	0.00	0.03
09/23/97	0.04	6.23	0.24	0.00	0.00	0.00
09/24/97	0.01	6.03	-0.19	0.00	0.00	0.20
09/25/97	0.04	6.18	0.14	0.00	0.00	0.00
09/26/97	0.23	6.27	0.09	0.00	0.00	0.13
09/27/97	0.05	6.46	0.19	0.00	0.00	0.00
09/28/97	0.15	6.30	-0.16	0.00	0.00	0.31
09/29/97	0.00	5.97	-0.34	0.00	0.00	0.34
09/30/97	0.00	6.12	0.16	0.00	0.00	0.00
10/01/97	0.22	6.35	0.22	0.00	0.00	0.00
10/02/97	0.39	10.05	3.70	0.00	0.00	0.00
10/03/97	0.19	9.66	-0.39	0.00	0.00	0.58
10/04/97	0.10	10.91	1.25	0.00	0.00	0.00
10/05/97	0.05	11.29	0.38	0.00	0.00	0.00
10/06/97	0.00	10.52	-0.78	0.00	0.00	0.78
10/07/97	0.01	11.13	0.61	0.00	0.00	0.00
10/08/97	0.14	10.92	-0.21	0.00	0.00	0.35
10/09/97	0.29	15.01	4.09	0.00	0.00	0.00
10/10/97	0.19	16.10	1.09	0.00	0.00	0.00
10/11/97	0.08	16.19	0.09	0.00	0.00	0.00
10/12/97	0.05	16.42	0.23	0.00	0.00	0.00
10/13/97	0.01	16.46	0.04	0.00	0.00	0.00
10/14/97	0.04	16.59	0.13	0.00	0.00	0.00
10/15/97	0.05	16.26	-0.33	0.00	0.00	0.38
10/16/97	0.00	14.71	-1.55	0.00	0.00	1.55
10/17/97	0.08	14.26	-0.45	0.00	0.00	0.52
10/18/97	0.00	11.55	-2.72	0.00	0.00	2.72
10/19/97	0.00	10.86	-0.69	0.00	0.00	0.69
10/20/97	0.00	9.99	-0.87	0.00	0.00	0.87
10/21/97	0.03	10.30	0.31	0.00	0.00	0.00
10/22/97	0.00	9.89	-0.41	0.00	0.00	0.41
10/23/97	0.00	9.01	-0.88	0.00	0.00	0.88

10/24/97	0.05	7.88	-1.13	0.00	0.00	1.18
10/25/97	0.00	8.28	0.40	0.00	0.00	0.00
10/26/97	0.00	7.58	-0.70	0.00	0.00	0.70
10/27/97	0.00	6.88	-0.70	0.00	0.00	0.70
10/28/97	0.00	7.88	1.01	0.00	0.00	0.00
10/29/97	0.06	7.23	-0.65	0.00	0.00	0.72
10/30/97	0.10	6.94	-0.29	0.00	0.00	0.39
10/31/97	0.15	15.45	8.51	0.00	0.00	0.00
11/01/97	0.17	17.18	1.73	0.00	0.00	0.00
11/02/97	0.10	16.65	-0.53	0.00	0.00	0.63
11/03/97	0.05	16.01	-0.64	0.00	0.00	0.69
11/04/97	0.03	17.88	1.87	0.00	0.00	0.00
11/05/97	0.03	17.50	-0.38	0.00	0.00	0.40
11/06/97	0.01	18.08	0.58	0.00	0.00	0.00
11/07/97	0.01	18.59	0.51	0.00	0.00	0.00
11/08/97	0.01	18.29	-0.31	0.00	0.00	0.32
11/09/97	0.01	16.99	-1.30	0.00	0.00	1.31
11/10/97	0.01	17.51	0.52	0.00	0.00	0.00
11/11/97	0.00	16.17	-1.33	0.00	0.00	1.33
11/12/97	0.00	15.79	-0.39	0.00	0.00	0.39
11/13/97	0.01	14.23	-1.56	0.00	0.00	1.58
11/14/97	0.01	13.51	-0.72	0.00	0.00	0.73
11/15/97	0.00	12.29	-1.21	0.00	0.00	1.21
11/16/97	0.00	11.59	-0.71	0.00	0.00	0.71
11/17/97	0.09	11.53	-0.06	0.06	0.08	0.00
11/18/97		11.28	-0.25	0.00	0.00	0.25
11/19/97		14.77	3.49	0.00	0.00	0.00
11/20/97		13.98	-0.79	0.00	0.00	0.79
11/21/97	0.01	12.44	-1.54	0.00	0.00	1.55
11/22/97	0.03	12.71	0.26	0.00	0.00	0.00
11/23/97	0.18	9.93	-2.78	0.00	0.00	2.95
11/24/97	0.00	11.38	1.45	0.00	0.00	0.00
11/25/97	0.10	9.69	-1.69	0.00	0.00	1.79
11/26/97	0.64	8.73	-0.96	0.00	0.00	1.59
11/27/97	0.01	9.11	0.38	0.00	0.00	0.00
11/28/97	0.19	10.81	1.70	0.00	0.00	0.00
11/29/97	0.58	10.79	-0.02	0.00	0.00	0.60
11/30/97	0.14	10.90	0.11	0.00	0.00	0.03
12/01/97	0.00	11.18	0.28	0.00	0.00	0.00
12/02/97	0.00	11.91	0.73	0.00	0.00	0.00
12/03/97	0.00	10.78	-1.13	0.00	0.00	1.13
12/04/97	0.05	9.90	-0.88	0.00	0.00	0.93
12/05/97	0.05	9.74	-0.16	0.00	0.00	0.21
12/06/97	0.17	10.45	0.71	0.00	0.00	0.00
12/07/97	0.19	10.13	-0.32	0.00	0.00	0.51
12/08/97	0.29	10.64	0.52	0.00	0.00	0.00
12/09/97	0.05	10.64	0.00	0.00	0.00	0.05

12/10/97	0.08	9.25	-1.39	0.00	0.00	1.47
12/11/97	0.01	10.32	1.07	0.00	0.00	0.00
12/12/97	0.00	10.30	-0.03	0.00	0.00	0.03
12/13/97	0.05	9.14	-1.16	0.00	0.00	1.21
12/14/97	0.00	9.67	0.53	0.00	0.00	0.00
12/15/97	0.06	9.73	0.06	0.00	0.00	0.01
12/16/97	0.01	9.55	-0.18	0.00	0.00	0.19
12/17/97	0.55	9.69	0.14	0.00	0.00	0.40
12/18/97	0.03	12.97	3.28	0.00	0.00	0.00
12/19/97	0.24	13.60	0.63	0.00	0.00	0.00
12/20/97	0.00	14.42	0.83	0.00	0.00	0.00
12/21/97	0.03	14.32	-0.10	0.00	0.00	0.13
12/22/97	0.05	13.05	-1.27	0.00	0.00	1.32
12/23/97	0.11	12.37	-0.68	0.00	0.00	0.79
12/24/97	0.17	11.01	-1.37	0.00	0.00	1.53
12/25/97	0.01	11.46	0.45	0.00	0.00	0.00
12/26/97	0.04	10.60	-0.86	0.00	0.00	0.90
12/27/97	0.11	9.83	-0.78	0.00	0.00	0.89
12/28/97	0.61	15.62	5.79	0.00	0.00	0.00
12/29/97	0.33	15.98	0.36	0.00	0.00	0.00
12/30/97						0.00
12/31/97						0.00
01/01/98	0.00	15.78	-0.19	0.00	0.00	0.19
01/02/98	0.00	16.20	0.41	0.00	0.00	0.00
01/03/98	0.00	16.47	0.28	0.00	0.00	0.00
01/04/98	0.06	16.27	-0.20	0.00	0.00	0.27
01/05/98	0.28	16.43	0.16	0.00	0.00	0.12
01/06/98	0.03	18.47	2.04	0.00	0.00	0.00
01/07/98	0.01	18.41	-0.06	0.00	0.00	0.07
01/08/98	0.00	18.51	0.10	0.00	0.00	0.00
01/09/98	0.01	17.49	-1.01	0.00	0.00	1.03
01/10/98	0.00	17.01	-0.48	0.00	0.00	0.48
01/11/98	0.00	16.00	-1.01	0.00	0.00	1.01
01/12/98	0.00	15.33	-0.67	0.00	0.00	0.67
01/13/98	0.01	14.69	-0.64	0.00	0.00	0.66
01/14/98	0.00	14.32	-0.36	0.00	0.00	0.36
01/15/98	0.00	13.39	-0.93	0.00	0.00	0.93
01/16/98	0.00	13.02	-0.37	0.00	0.00	0.37
01/17/98	0.14	12.20	-0.82	0.00	0.00	0.96
01/18/98	0.04	13.04	0.84	0.03	0.00	0.00
01/19/98	0.01	12.23	-0.80	0.00	0.00	0.82
01/20/98	0.01	13.23	1.00	0.00	0.00	0.00
01/21/98	0.00	12.68	-0.55	0.00	0.00	0.55
01/22/98	0.01	11.96	-0.72	0.00	0.00	0.74
01/23/98	0.00	11.00	-0.96	0.00	0.00	0.96
01/24/98	0.00	11.07	0.07	0.00	0.00	0.00

01/25/98	0.04	10.58	-0.49	0.00	0.00	0.53
01/26/98	0.00	10.34	-0.24	0.00	0.00	0.24
01/27/98	0.10	9.88	-0.46	0.00	0.00	0.56
01/28/98	0.01	9.48	-0.40	0.00	0.00	0.41
01/29/98	0.00	9.30	-0.18	0.00	0.00	0.18
01/30/98	0.00	8.67	-0.63	0.00	0.00	0.63
01/31/98	0.00	8.36	-0.31	0.00	0.00	0.31
02/01/98	0.22	8.74	0.38	0.00	0.00	0.00
02/02/98	0.01	8.96	0.22	0.00	0.00	0.00
02/03/98	0.00	8.18	-0.78	0.00	0.00	0.78
02/04/98	0.04	8.60	0.43	0.00	0.00	0.00
02/05/98	0.00	7.78	-0.83	0.00	0.00	0.83
02/06/98	0.00	7.93	0.15	0.00	0.00	0.00
02/07/98	0.00	7.79	-0.14	0.00	0.00	0.14
02/08/98	0.00	7.60	-0.19	0.00	0.00	0.19
02/09/98	0.00	7.64	0.04	0.00	0.00	0.00
02/10/98	0.00	7.53	-0.12	0.00	0.00	0.12
02/11/98	0.00	7.78	0.26	0.00	0.00	0.00
02/12/98	0.00	7.14	-0.64	0.00	0.00	0.64
02/13/98	0.05	7.37	0.22	0.00	0.00	0.00
02/14/98	0.03	7.16	-0.21	0.00	0.00	0.24
02/15/98	0.00	6.35	-0.80	0.00	0.00	0.80
02/16/98	0.00	7.08	0.72	0.00	0.00	0.00
02/17/98	0.00			0.00	0.00	0.00
02/18/98	0.00	6.97	-0.11	0.00	0.00	0.11
02/19/98	0.00	6.78	6.78	0.00	0.00	0.00
02/20/98	0.00	5.99	-0.98	0.00	0.00	0.98
02/21/98	0.00	6.63	-0.16	0.00	0.00	0.16
02/22/98	0.04	6.30	0.30	0.00	0.00	0.00
02/23/98	0.00	5.58	-1.05	0.00	0.00	1.05
02/24/98	0.03	5.69	-0.61	0.00	0.00	0.64
02/25/98	0.00	6.47	0.89	0.00	0.00	0.00
02/26/98	0.00	5.86	0.18	0.00	0.00	0.00
02/27/98	0.00	6.44	-0.02	0.00	0.00	0.02
02/28/98	0.00	0.00	-5.86	0.00	0.00	5.86
03/01/98	0.13	6.35	-0.10	0.00	0.00	0.22
03/02/98	0.03	5.25	5.25	0.00	0.00	0.00
03/03/98	0.01	6.38	0.03	0.00	0.00	0.00
03/04/98	0.00	6.43	1.18	0.00	0.00	0.00
03/05/98	0.00	6.73	0.35	0.00	0.00	0.00
03/06/98	0.00	5.52	-0.92	0.00	0.00	0.92
03/07/98	0.00	6.55	-0.18	0.00	0.00	0.18
03/08/98	0.05	5.87	0.35	0.00	0.00	0.00
03/09/98	0.00	6.46	-0.09	0.00	0.00	0.09
03/10/98	0.00	5.62	-0.26	0.00	0.00	0.26

03/11/98	0.00	5.88	-0.59	0.00	0.00	0.59
03/12/98	0.00	6.68	1.07	0.00	0.00	0.00
03/13/98	0.00	5.46	-0.42	0.00	0.00	0.42
03/14/98	0.00	6.41	-0.28	0.00	0.00	0.28
03/15/98	0.00	6.15	0.69	0.00	0.00	0.00
03/16/98	0.20	6.68	0.27	0.00	0.00	0.00
03/17/98	0.00	5.35	-0.80	0.00	0.00	0.80
03/18/98	0.00	5.27	-1.41	0.00	0.00	1.41
03/19/98	0.00	6.28	0.94	0.00	0.00	0.00
03/20/98	0.00	6.23	0.95	0.00	0.00	0.00
03/21/98	0.04	5.32	-0.96	0.00	0.00	1.00
03/22/98	0.08	5.84	-0.39	0.00	0.00	0.47
03/23/98	0.00	4.80	-0.52	0.00	0.00	0.52
03/24/98	0.06	4.67	-1.17	0.00	0.00	1.23
03/25/98	0.04	4.54	-0.25	0.00	0.00	0.29
03/26/98	0.14	4.76	0.09	0.00	0.00	0.05
03/27/98	0.00	4.57	0.03	0.00	0.00	0.00
03/28/98	0.00	4.78	0.03	0.00	0.00	0.00
03/29/98	0.09	4.75	0.19	0.00	0.00	0.00
03/30/98	0.00	5.01	0.23	0.00	0.00	0.00

APPENDIX Q (Cont.)

WEEKLY WATER BALANCE ON SOIL PLOTS (Units are in cm)						
Week Beginning	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
7/24/97	0.38	9.75	-1.12	0.00	0.00	1.50
7/31/97	0.18	9.99	0.24	0.00	0.00	0.00
8/8/97	0.11	7.79	-2.20	0.00	0.00	2.31
8/16/97	1.03	7.31	-0.48	0.00	0.00	1.51
8/24/98	0.00		-7.31	0.00	0.00	7.31
8/31/98	2.22	7.11	7.11	0.00	0.00	0.00
9/8/98	2.11	13.54	6.43	0.00	0.00	0.00
9/16/98	0.39	11.03	-2.51	0.00	0.00	2.90
9/23/98	0.32	9.32	-1.71	0.00	0.00	2.02
9/30/98	0.24	8.07	-1.25	0.00	0.00	1.49
10/8/98	0.06	6.55	-1.52	0.00	0.00	1.59
10/16/98	0.37	6.27	-0.28	0.00	0.00	0.65
10/24/98	0.56	5.83	-0.44	0.00	0.00	1.00
10/31/98	0.03	6.69	0.86	0.00	0.00	0.00
11/8/98	15.68	11.67	4.98	0.51	0.41	9.78
11/16/98	21.49	24.33	12.66	2.62	3.40	0.00
11/23/98	1.24	30.69	6.36	0.13	0.40	0.00
11/30/98	0.06	23.75	-6.94	0.01	0.02	6.97
12/8/98	0.90	24.42	0.66	0.00	0.00	0.24
12/16/98	1.32	24.50	0.09	0.01	0.00	1.23
12/24/98	1.09	19.67	-4.83	0.01	0.00	5.91
12/31/98	2.32	22.98	3.31	0.04	0.03	0.00
1/8/98	4.23	23.88	0.90	0.58	1.30	1.45
1/16/98	0.58	23.51	-0.37	0.00	0.03	0.92
1/24/98	6.65	23.63	0.12	1.34	0.13	5.07
1/31/98	1.14	23.42	-0.21	0.00	0.00	1.36
2/7/98	0.05	23.08	-0.34	0.00	0.00	0.39
2/14/98	0.03	19.86	-3.21	0.00	0.00	3.24
2/21/98	0.24	12.87	-6.99	0.00	0.00	7.23
2/28/98	0.98	14.25	1.38	0.00	0.00	0.00
3/8/98	0.86	14.07	-0.18	0.00	0.00	1.04
3/16/98	0.60	15.72	1.65	0.05	0.00	0.00
3/24/98	0.15	23.01	7.28	0.41	0.05	0.00
3/31/98	3.29	19.22	-3.79	0.00	0.00	7.08
4/8/98	4.85	23.76	4.54	0.17	0.39	0.00
4/16/98	0.10	16.68	-7.08	0.00	0.00	7.18
4/23/98	0.00	5.93	-10.75	0.00	0.00	10.75
4/30/98	0.06	13.41	7.49	0.00	0.00	0.00
5/8/98	3.02	16.04	2.62	0.22	0.42	0.00
5/16/98	1.14	21.28	5.24	0.00	0.00	0.00
5/24/98	0.29	19.63	-1.65	0.00	0.00	1.94
5/31/98	0.00	14.97	-4.66	0.05	0.00	4.61

6/8/98	0.53	12.89	-2.08	0.00	0.00	2.61
6/16/98	0.61	11.18	-1.71	0.00	0.00	2.32
6/23/98	0.57	10.14	-1.04	0.00	0.00	1.61
6/30/98	0.57	8.68	-1.46	0.00	0.00	2.03
7/8/98	0.80	7.92	-0.77	0.00	0.00	1.57
7/16/98	0.34	7.42	-0.50	0.00	0.00	0.84
7/24/98	2.04	9.09	1.67	0.00	0.00	0.38
7/31/98	0.91	10.84	1.75	0.00	0.00	0.00
8/8/98	0.04	9.89	-0.95	0.00	0.00	0.98
8/16/98	0.51	7.69	-2.20	0.00	0.00	2.71
8/24/98	0.17	7.12	-0.57	0.00	0.00	0.74
8/31/98	0.33	6.86	-0.26	0.00	0.00	0.59
9/8/98	0.01	6.53	-0.33	0.00	0.00	0.34
9/16/98	0.33	6.23	-0.30	0.00	0.00	0.63
9/23/98	0.39	5.99	-0.24	0.00	0.00	0.63
9/30/98	0.48	6.19	0.20	0.00	0.00	0.28
10/8/98	1.10	10.10	3.91	0.00	0.00	0.00
10/16/98	0.71	15.97	5.86	0.00	0.00	0.00
10/24/98	0.15	10.47	-5.50	0.00	0.00	5.65
10/31/98	0.32	8.61	-1.86	0.00	0.00	2.18
11/8/98	0.41	17.52	8.92	0.00	0.00	0.00
11/16/98	0.05	14.76	-2.76	0.00	0.00	2.81
11/23/98	0.30	14.44	-0.32	0.00	0.00	0.00
11/30/98	1.66	10.08	-4.36	0.00	0.00	6.02
12/8/98	0.75	10.59	0.51	0.00	0.00	0.24
12/16/98	0.27	9.82	-0.77	0.00	0.00	1.03
12/24/98	1.17	12.92	3.09	0.00	0.00	0.00
12/31/98	1.10	12.41	-0.50	0.00	0.00	1.61
1/8/98	0.38	17.07	4.65	0.00	0.00	0.00
1/15/98	0.03	15.46	-1.61	0.00	0.00	1.63
1/23/98	0.22	12.42	-3.04	0.03	0.00	3.23
1/31/98	0.15	9.71	-2.71	0.00	0.00	2.86
2/7/98	0.27	8.28	-1.43	0.00	0.00	1.69
2/14/98	0.08	7.46	-0.82	0.00	0.00	0.90
2/21/98	0.00	6.63	-0.83	0.00	0.00	0.83
2/28/98	0.06	4.54	-2.09	0.00	0.00	2.16
3/8/98	0.22	6.13	1.59	0.00	0.00	0.00
3/16/98	0.20	6.17	0.03	0.00	0.00	0.17
3/23/98	0.11	5.58	-0.58	0.00	0.00	0.70
3/30/98	0.33	4.73	-0.86	0.00	0.00	1.19

APPENDIX Q (Cont.)

MONTHLY WATER BALANCE ON SOIL PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff	Percolation (L)	ET
Jul-96	0.56	9.87	-1.00	0.00	0.02	1.54
Aug-96	3.37	7.40	-2.47	0.00	0.00	5.83
Sep-96	3.06	10.49	3.09	0.00	0.01	0.00
Oct-96	1.02	6.33	-4.16	0.00	0.00	5.17
Nov-96	38.48	22.61	16.28	4.48	4.24	13.49
Dec-96	5.64	22.89	0.28	0.07	0.03	5.26
Jan-97	12.61	23.61	0.72	1.92	1.45	8.52
Feb-97	1.30	17.52	-6.10	0.00	0.00	7.39
Mar-97	4.90	18.01	0.49	0.46	0.05	3.90
Apr-97	5.02	14.94	-3.06	0.17	0.17	7.73
May-97	4.46	17.98	3.03	0.27	0.42	0.73
Jun-97	2.29	10.72	-7.25	0.00	0.00	9.54
Jul-97	4.10	8.82	-1.91	0.00	0.00	6.01
Aug-97	1.04	7.89	-0.93	0.00	0.00	1.97
Sep-97	1.22	6.23	-1.66	0.00	0.00	2.87
Oct-97	2.29	11.29	5.05	0.00	0.00	0.00
Nov-97	2.43	14.20	2.92	0.06	0.08	0.00
Dec-97	3.29	11.44	-2.76	0.00	0.00	6.05
Jan-98	0.77	13.67	2.23	0.03	0.00	0.00
Feb-98	0.41	6.73	-6.94	0.00	0.00	7.34
Mar-98	0.86	5.65	-1.08	0.00	0.00	1.94

APPENDIX R. Daily, weekly, and monthly water balance on 20% IC plots at MCBH

DAILY WATER BALANCE ON 20% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff	Percolation (L)	ET
07/19/96	0.03	9.85		0.00	0.00	0.03
07/20/96	0.00	10.86	1.01	0.00	0.00	0.00
07/21/96	0.00	10.97	0.10	0.00	0.00	0.00
07/22/96	0.36	10.07	-0.90	0.00	0.00	1.25
07/23/96	0.00	11.38	1.31	0.00	0.00	0.00
07/24/96	0.00	10.48	-0.90	0.00	0.00	0.90
07/25/96	0.00			0.00	0.00	0.00
07/26/96	0.00	10.24	-0.24	0.00	0.00	0.24
07/27/96	0.18			0.00	0.00	0.18
07/28/96	0.00			0.00	0.00	0.00
07/29/96	0.00	10.14	-0.10	0.00	0.00	0.10
07/30/96	0.00	9.93	-0.22	0.00	0.00	0.22
07/31/96				0.00	0.00	0.00
08/01/96	0.04	9.68	-0.25	0.00	0.00	0.29
08/02/96	0.00	10.13	0.45	0.00	0.00	0.00
08/03/96	0.00	9.10	-1.03	0.00	0.00	1.03
08/04/96	0.03	9.91	0.81	0.00	0.00	0.00
08/05/96	0.00	9.14	-0.77	0.00	0.00	0.77
08/06/96	0.04	9.06	-0.08	0.00	0.00	0.11
08/07/96	0.01	9.40	0.34	0.00	0.00	0.00
08/08/96	0.00	8.66	-0.73	0.00	0.00	0.73
08/09/96	0.09	8.00	-0.67	0.00	0.00	0.76
08/10/96	0.05	7.53	-0.46	0.00	0.00	0.51
08/11/96	0.56			0.00	0.00	0.56
08/12/96	0.00		-7.53	0.00	0.00	7.53
08/13/96	0.33	9.49	1.95	0.00	0.00	0.00
08/14/96	0.00	9.24	-0.24	0.00	0.00	0.24
08/15/96	0.00	9.90	0.66	0.00	0.00	0.00
08/16/96	0.00		-9.90	0.00	0.00	9.90
08/17/96	0.00		0.00	0.00	0.00	0.00
08/18/96	0.00		0.00	0.00	0.00	0.00
08/19/96	0.00		0.00	0.00	0.00	0.00
08/20/96	0.00		0.00	0.00	0.00	0.00
08/21/96	0.00		0.00	0.00	0.00	0.00
08/22/96	0.00		0.00	0.00	0.00	0.00
08/23/96	0.00		0.00	0.00	0.00	0.00
08/24/96	0.00		0.00	0.00	0.00	0.00
08/25/96	0.00		0.00	0.00	0.00	0.00
08/26/96	0.00	8.18	8.18	0.00	0.00	0.00
08/27/96	0.05	7.99	-0.18	0.00	0.00	0.23
08/28/96	0.00			0.00	0.00	0.00

08/29/96	0.00	7.38	-0.62	0.00	0.00	0.62
08/30/96	0.14	8.62	1.24	0.00	0.00	0.00
08/31/96	2.03	9.92	1.30	0.00	0.00	0.73
09/01/96	0.00	13.33	3.41	0.00	0.00	0.00
09/02/96	0.00	13.11	-0.21	0.00	0.00	0.21
09/03/96	0.00	12.94	-0.18	0.00	0.00	0.18
09/04/96	0.30	12.96	0.03	0.00	0.00	0.28
09/05/96	0.71	13.09	0.12	0.00	0.00	0.59
09/06/96	0.46	12.93	-0.15	0.00	0.00	0.61
09/07/96	0.20			0.00	0.00	0.20
09/08/96	0.43	13.67	0.74	0.00	0.00	0.00
09/09/96	0.00			0.00	0.00	0.00
09/10/96	0.01	13.58	-0.10	0.00	0.00	0.11
09/11/96	0.25			0.00	0.00	0.25
09/12/96	0.05			0.00	0.00	0.05
09/13/96	0.00	12.22	-1.36	0.00	0.00	1.36
09/14/96	0.00	11.52	-0.70	0.00	0.00	0.70
09/15/96	0.08	11.41	-0.10	0.00	0.00	0.18
09/16/96	0.00	11.25	-0.16	0.00	0.00	0.16
09/17/96	0.00	11.18	-0.07	0.00	0.00	0.07
09/18/96	0.00	10.84	-0.34	0.00	0.00	0.34
09/19/96	0.19	10.80	-0.04	0.00	0.00	0.23
09/20/96	0.13	10.59	-0.21	0.00	0.00	0.34
09/21/96	0.00	10.43	-0.16	0.00	0.00	0.16
09/22/96	0.00	10.65	0.23	0.00	0.00	0.00
09/23/96	0.00	10.44	-0.21	0.00	0.00	0.21
09/24/96	0.00	9.63	-0.81	0.06	0.00	0.75
09/25/96	0.00	10.03	0.40		0.00	
09/26/96	0.00	9.04	-0.99		0.00	
09/27/96	0.00	8.84	-0.20		0.00	
09/28/96	0.00	10.34	1.49		0.00	
09/29/96	0.00	9.41	-0.92		0.00	
09/30/96	0.00	8.52	-0.89	0.00	0.00	0.89
10/01/96	0.00	7.24	-1.28	0.00	0.00	1.28
10/02/96	0.00	8.22	0.98	0.00	0.00	0.00
10/03/96	0.00	8.23	0.01	0.00	0.00	0.00
10/04/96	0.00	8.24	0.01	0.00	0.00	0.00
10/05/96	0.00	7.05	-1.19	0.00	0.00	1.19
10/06/96	0.00			0.00	0.00	0.00
10/07/96	0.06	8.42	1.37	0.00	0.00	0.00
10/08/96	0.00	8.33	-0.09	0.00	0.00	0.09
10/09/96	0.00	8.22	-0.11	0.00	0.00	0.11
10/10/96	0.05	7.04	-1.18	0.00	0.00	1.23
10/11/96	0.00	8.10	1.06	0.00	0.00	0.00
10/12/96	0.00	7.87	-0.23	0.00	0.00	0.23
10/13/96	0.00	8.06	0.19	0.00	0.00	0.00

10/14/96	0.04	7.74	-0.32	0.00	0.00	0.36
10/15/96	0.17	7.81	0.07	0.00	0.00	0.10
10/16/96	0.11	8.81	1.00	0.00	0.00	0.00
10/17/96	0.00	9.02	0.21	0.00	0.00	0.00
10/18/96	0.00	6.54	-2.48	0.00	0.00	2.48
10/19/96	0.41	9.56	3.02	0.00	0.00	0.00
10/20/96	0.14	8.59	-0.97	0.00	0.00	1.11
10/21/96	0.00	8.99	0.40	0.00	0.00	0.00
10/22/96	0.00	9.38	0.39	0.00	0.00	0.00
10/23/96	0.01	9.28	-0.10	0.00	0.00	0.12
10/24/96	0.00	8.48	-0.80	0.00	0.00	0.80
10/25/96	0.00	9.35	0.87	0.00	0.00	0.00
10/26/96	0.00	8.53	-0.82	0.00	0.00	0.82
10/27/96	0.00	8.59	0.06	0.00	0.00	0.00
10/28/96	0.00	7.40	-1.19	0.00	0.00	1.19
10/29/96	0.03	8.60	1.20	0.00	0.00	0.00
10/30/96	0.00	9.21	0.62	0.00	0.00	0.00
10/31/96	0.00			0.00	0.00	0.00
11/01/96	0.00	7.70	-1.51	0.00	0.00	1.51
11/02/96	0.27	7.66	-0.04	0.00	0.00	0.31
11/03/96	0.00	7.74	0.09	0.00	0.00	0.00
11/04/96	0.00	8.67	0.93	0.00	0.00	0.00
11/05/96	11.91	8.29	-0.38	3.10	0.09	9.10
11/06/96	0.05	6.07	-2.22	0.05	0.00	2.22
11/07/96	0.06	24.76	18.69	0.00	0.00	0.00
11/08/96	3.39	24.42	-0.33	0.38	0.00	3.35
11/09/96	0.00	25.10	0.68	0.00	0.00	0.00
11/10/96	0.01	24.08	-1.02	0.00	0.00	1.03
11/11/96	0.01	23.68	-0.41	0.00	0.00	0.42
11/12/96	5.65	23.78	0.11	1.47	0.00	4.08
11/13/96	2.81	23.75	-0.03	1.56	0.00	1.28
11/14/96	5.54	24.30	0.55	1.60	0.00	3.39
11/15/96	1.68	24.54	0.24	0.09	0.09	1.26
11/16/96	5.79			1.90	1.65	2.24
11/17/96	1.12	24.65	0.11	0.17	0.14	0.70
11/18/96	0.11	24.83	0.18	0.00	0.00	0.00
11/19/96	0.00				0.00	0.00
11/20/96	0.00			0.08	0.00	0.00
11/21/96	0.00	24.35	-0.48	0.00	0.00	0.48
11/22/96	0.01	24.28	-0.07	0.00	0.00	0.08
11/23/96	0.00	23.97	-0.30	0.00	0.00	0.30
11/24/96	0.04	23.71	-0.27	0.00	0.00	0.31
11/25/96	0.00			0.00	0.00	0.00
11/26/96	0.00	24.09	0.39	0.00	0.00	0.00
11/27/96	0.00	23.87	-0.23	0.00	0.00	0.23
11/28/96	0.03	23.61	-0.26	0.00	0.00	0.28
11/29/96	0.00	23.04	-0.57	0.00	0.00	0.57

11/30/96	0.00	23.01	-0.04	0.00	0.00	0.04
12/01/96	0.00	22.76	-0.25	0.00	0.00	0.25
12/02/96	0.00	22.46	-0.30	0.00	0.00	0.30
12/03/96	0.28			0.00	0.00	0.28
12/04/96	0.05	21.11	-1.35	0.00	0.00	1.40
12/05/96	0.09	21.57	0.46	0.00	0.00	0.00
12/06/96	0.01	20.59	-0.98	0.00	0.00	1.00
12/07/96	0.43	20.46	-0.13	0.00	0.00	0.56
12/08/96	0.04	20.11	-0.35	0.00	0.00	0.39
12/09/96	0.00			0.00	0.00	0.00
12/10/96	0.09	19.97	-0.14	0.00	0.00	0.23
12/11/96	0.32	19.55	-0.42	0.05	0.00	0.69
12/12/96	0.05	19.81	0.26	0.00	0.00	0.00
12/13/96	0.10	20.66	0.85	0.00	0.00	0.00
12/14/96	0.74			0.00	0.00	0.74
12/15/96	0.03			0.00	0.00	0.03
12/16/96	0.00	21.63	0.97	0.00	0.00	0.00
12/17/96	0.00			0.00	0.00	0.00
12/18/96	0.00	20.68	-0.96	0.00	0.00	0.96
12/19/96	0.00	20.74	0.06	0.00	0.00	0.00
12/20/96	0.00	20.68	-0.05	0.00	0.00	0.05
12/21/96	0.17			0.00	0.00	0.17
12/22/96	0.25	20.65	-0.03	0.00	0.00	0.29
12/23/96	0.47	20.51	-0.14	0.05	0.00	0.56
12/24/96	0.20	20.72	0.21	0.00	0.00	0.00
12/25/96	0.00			0.00	0.00	0.00
12/26/96	0.34	21.10	0.38	0.00	0.00	0.00
12/27/96	1.03	23.63	2.53	0.15	0.00	0.00
12/28/96	0.43			0.00	0.00	0.43
12/29/96	0.00	23.06	-0.57	0.00	0.00	0.57
12/30/96	0.04			0.00	0.00	0.04
12/31/96	0.48	22.74	-0.32	0.05	0.00	0.75
01/01/97	0.33			0.05	0.00	0.28
01/02/97	0.00			0.00	0.00	0.00
01/03/97	0.18	23.23	0.49	1.56	0.09	0.00
01/04/97	3.06	24.31	1.08	0.05	0.11	1.83
01/05/97	0.24	23.93	-0.39	0.05	0.04	0.54
01/06/97	0.15			0.00	0.00	0.15
01/07/97	0.13	23.72	-0.21	0.00	0.00	0.33
01/08/97	0.14	23.70	-0.02	0.00	0.00	0.16
01/09/97	0.15	23.35	-0.35	0.00	0.00	0.50
01/10/97	0.20	23.48	0.13	0.00	0.00	0.07
01/11/97	0.23			0.00	0.00	0.23
01/12/97		23.76	0.28			0.00
01/13/97		22.97	-0.79			0.79
01/14/97		23.07	0.10			0.00
01/15/97		23.21	0.14			0.00

01/16/97		23.43	0.22			0.00
01/17/97	0.00	22.95	-0.48	0.00	0.00	0.48
01/18/97	0.00	22.74	-0.21	0.00	0.00	0.21
01/19/97	5.51	22.74	0.00	1.81	0.00	3.70
01/20/97	0.06	23.70	0.96	0.00	0.00	0.00
01/21/97	1.08	23.27	-0.43	0.10	0.00	1.41
01/22/97	0.00	23.55	0.28	0.00	0.00	0.00
01/23/97	0.00	23.25	-0.29	0.00	0.00	0.29
01/24/97	0.00	22.94	-0.31	0.00	0.00	0.31
01/25/97	0.00	22.63	-0.31	0.00	0.00	0.31
01/26/97	0.00	22.80	0.17	0.00	0.00	0.00
01/27/97	0.00	22.77	-0.03	0.00	0.00	0.03
01/28/97	0.04	22.82	0.05	0.00	0.00	0.00
01/29/97	0.89	22.81	0.00	0.05	0.00	0.84
01/30/97	0.11	23.34	0.53	0.00	0.00	0.00
01/31/97	0.10	23.42	0.08	0.00	0.00	0.02
02/01/97	0.00	23.25	-0.18	0.00	0.00	0.18
02/02/97	0.05	23.18	-0.07	0.00	0.00	0.12
02/03/97	0.00			0.00	0.00	0.00
02/04/97	0.00			0.00	0.00	0.00
02/05/97	0.00	22.59	-0.59	0.00	0.00	0.59
02/06/97	0.00	22.01	-0.58	0.00	0.00	0.58
02/07/97	0.00	22.00	-0.01	0.00	0.00	0.01
02/08/97	0.00	21.77	-0.23	0.00	0.00	0.23
02/09/97	0.00	21.31	-0.46	0.00	0.00	0.46
02/10/97	0.03	21.14	-0.17	0.00	0.00	0.20
02/11/97	0.00	20.45	-0.69	0.00	0.00	0.69
02/12/97	0.00	19.35	-1.10	0.00	0.00	1.10
02/13/97	0.00	18.68	-0.67	0.00	0.00	0.67
02/14/97	0.00	17.46	-1.21	0.00	0.00	1.21
02/15/97	0.00			0.00	0.00	0.00
02/16/97	0.00	16.96	-0.50	0.00	0.00	0.50
02/17/97	0.00	16.15	-0.82	0.00	0.00	0.82
02/18/97	0.00	16.25	0.10	0.00	0.00	0.00
02/19/97	0.00	15.33	-0.91	0.00	0.00	0.91
02/20/97	0.00	14.97	-0.36	0.00	0.00	0.36
02/21/97	0.24	14.74	-0.24	0.00	0.00	0.48
02/22/97	0.38	14.20	-0.54	0.00	0.00	0.92
02/23/97	0.04	14.15	-0.05	0.00	0.00	0.08
02/24/97	0.00	13.75	-0.41	0.00	0.00	0.41
02/25/97	0.18	13.90	0.15	0.00	0.00	0.03
02/26/97	0.28	14.23	0.33	0.00	0.00	0.00
02/27/97	0.08	13.88	-0.34	0.00	0.00	0.42
02/28/97	0.03	14.07	0.19	0.00	0.00	0.00
03/01/97	0.15			0.00	0.00	0.15
03/02/97	0.06	14.21	0.14	0.00	0.00	0.00
03/03/97	0.00	14.14	-0.08	0.00	0.00	0.08

03/04/97	0.28	13.93	-0.21	0.00	0.00	0.49
03/05/97	0.28	14.72	0.79	0.00	0.00	0.00
03/06/97	0.08	14.14	-0.59	0.03	0.00	0.63
03/07/97	0.01	14.09	-0.05	0.00	0.00	0.06
03/08/97	0.00	13.96	-0.13	0.00	0.00	0.13
03/09/97	0.04	13.75	-0.21	0.00	0.00	0.25
03/10/97	0.01	13.55	-0.20	0.00	0.00	0.21
03/11/97	0.36	18.32	4.77	0.15	0.00	0.00
03/12/97	0.06	19.50	1.18	0.00	0.00	0.00
03/13/97	0.03	20.35	0.85	0.09	0.00	0.00
03/14/97	0.05	20.74	0.39	0.03	0.00	0.00
03/15/97	0.04	20.83	0.08	0.00	0.00	0.00
03/16/97	0.01	20.88	0.06	0.00	0.00	0.00
03/17/97	0.01	23.61	2.72	0.65	0.00	0.00
03/18/97	0.04	22.54	-1.07	0.00	0.00	1.10
03/19/97	0.04	22.09	-0.45	0.00	0.00	0.49
03/20/97	0.01	22.05	-0.04	0.00	0.00	0.05
03/21/97	0.01	21.75	-0.30	0.00	0.00	0.32
03/22/97	0.01	21.58	-0.17	0.00	0.00	0.18
03/23/97	0.01	23.52	1.93	0.04	0.00	0.00
03/24/97	0.01			0.09	0.00	0.00
03/25/97	1.22			0.00	0.00	1.22
03/26/97	0.01	23.14	-0.38	0.00	0.00	0.39
03/27/97	0.15	23.05	-0.08	0.00	0.00	0.24
03/28/97	0.04	22.87	-0.18	0.00	0.00	0.22
03/29/97	0.00	22.49	-0.38	0.00	0.00	0.38
03/30/97	0.00	22.23	-0.26	0.00	0.00	0.26
03/31/97	1.87	21.03	-1.19	0.07	0.16	2.82
04/01/97	3.07	24.22	3.19	0.24	0.00	0.00
04/02/97	1.24	23.96	-0.26	0.19	0.00	1.31
04/03/97	0.00	23.57	-0.39	0.00	0.00	0.39
04/04/97	0.47	23.29	-0.28	0.00	0.00	0.75
04/05/97	0.03	23.22	-0.07	0.00	0.00	0.10
04/06/97	0.00	22.97	-0.25	0.00	0.00	0.25
04/07/97	0.04	22.73	-0.24	0.00	0.00	0.27
04/08/97	0.00	22.46	-0.27	0.00	0.00	0.27
04/09/97	0.08	21.57	-0.89	0.00	0.00	0.97
04/10/97	0.03	20.51	-1.07	0.00	0.00	1.09
04/11/97	0.00	19.63	-0.88	0.00	0.00	0.88
04/12/97	0.00	19.15	-0.48	0.00	0.00	0.48
04/13/97	0.00	19.00	-0.16	0.00	0.00	0.16
04/14/97	0.00	18.66	-0.34	0.00	0.00	0.34
04/15/97	0.00	18.15	-0.51	0.00	0.00	0.51
04/16/97	0.00	17.79	-0.35	0.00	0.00	0.35
04/17/97	0.00	17.29	-0.50	0.00	0.00	0.50
04/18/97	0.00	16.24	-1.05	0.00	0.00	1.05
04/19/97	0.00	16.07	-0.17	0.00	0.00	0.17

04/20/97	0.00	15.72	-0.35	0.00	0.00	0.35
04/21/97	0.00	15.18	-0.54	0.00	0.00	0.54
04/22/97	0.00	14.81	-0.36	0.00	0.00	0.36
04/23/97	0.00					0.00
04/24/97	0.00					0.00
04/25/97	0.00					0.00
04/26/97	0.00					0.00
04/27/97	0.04	14.34	-0.47	0.00	0.00	0.51
04/28/97	0.03	13.56	-0.78	0.00	0.00	0.81
04/29/97	0.00	13.40	-0.16	0.00	0.00	0.16
04/30/97	0.00	12.88	-0.51	0.00	0.00	0.51
05/01/97	0.00	13.73	0.84	0.00	0.00	0.00
05/02/97	0.04	12.90	-0.82	0.00	0.00	0.86
05/03/97	0.00	12.21	-0.69	0.00	0.00	0.69
05/04/97	0.20	12.28	0.06	0.00	0.00	0.14
05/05/97	1.64	11.71	-0.57	0.27	0.00	1.93
05/06/97	0.99	22.15	10.45	0.47	0.00	0.00
05/07/97	0.14	22.31	0.16	0.00	0.00	0.00
05/08/97	0.01	22.19	-0.12	0.00	0.00	0.14
05/09/97	0.01	22.24	0.05	0.00	0.00	0.00
05/10/97	0.23	21.69	-0.55	0.00	0.00	0.78
05/11/97	0.00	21.66	-0.03	0.00	0.00	0.03
05/12/97	0.01	21.38	-0.28	0.00	0.00	0.29
05/13/97	0.32	21.33	-0.04	0.04	0.00	0.32
05/14/97	0.04	21.36	0.02	0.00	0.00	0.01
05/15/97	0.43	21.75	0.39	0.00	0.00	0.04
05/16/97	0.10	21.70	-0.04	0.00	0.00	0.14
05/17/97	0.00	21.53	-0.17	0.00	0.00	0.17
05/18/97	0.01	21.27	-0.26	0.00	0.00	0.27
05/19/97	0.00	20.94	-0.33	0.00	0.00	0.33
05/20/97	0.00	20.49	-0.45	0.00	0.00	0.45
05/21/97	0.20	19.94	-0.55	0.04	0.00	0.72
05/22/97	0.06	19.46	-0.48	0.00	0.00	0.54
05/23/97	0.01	19.13	-0.33	0.00	0.00	0.34
05/24/97	0.00	18.67	-0.46	0.00	0.00	0.46
05/25/97	0.00	18.20	-0.47	0.00	0.00	0.47
05/26/97	0.00	17.48	-0.73	0.00	0.00	0.73
05/27/97	0.00					0.00
05/28/97						0.00
05/29/97		13.73	-3.75			3.75
05/30/97		13.32	13.32			0.00
05/31/97		12.80	12.80			0.00
06/01/97		12.97	-0.76			0.76
06/02/97	0.00	12.79	-0.18	0.00	0.00	0.18

06/03/97	0.37	12.87	0.08	0.00	0.00	0.29
06/04/97	0.14	12.48	-0.39	0.00	0.00	0.53
06/05/97	0.01	12.61	0.13	0.00	0.00	0.00
06/06/97	0.00	12.13	-0.48	0.00	0.00	0.48
06/07/97	0.01	12.22	0.09	0.00	0.00	0.00
06/08/97	0.00	12.37	0.15	0.00	0.00	0.00
06/09/97	0.01	12.14	-0.22	0.00	0.00	0.24
06/10/97	0.36	11.82	-0.33	0.00	0.00	0.68
06/11/97	0.05	11.35	-0.47	0.00	0.00	0.52
06/12/97	0.04	11.43	0.08	0.00	0.00	0.00
06/13/97	0.01	11.49	0.06	0.00	0.00	0.00
06/14/97	0.10	11.16	-0.34	0.00	0.00	0.44
06/15/97	0.00	11.04	-0.11	0.00	0.00	0.11
06/16/97	0.04	10.66	-0.38	0.00	0.00	0.42
06/17/97	0.13	10.73	0.07	0.00	0.00	0.06
06/18/97	0.00	11.29	0.55	0.00	0.00	0.00
06/19/97	0.00	10.58	-0.71	0.00	0.00	0.71
06/20/97	0.22	10.46	-0.12	0.00	0.00	0.33
06/21/97	0.00	10.31	-0.14	0.00	0.00	0.14
06/22/97	0.14	10.32	0.00	0.00	0.00	0.14
06/23/97	0.09	10.05	-0.27	0.00	0.00	0.36
06/24/97	0.00	10.00	-0.04	0.00	0.00	0.04
06/25/97	0.14			0.00	0.00	0.14
06/26/97	0.00	10.02	0.02	0.00	0.00	0.00
06/27/97	0.09	9.02	-1.00	0.00	0.00	1.09
06/28/97	0.30	9.73	0.71	0.00	0.00	0.00
06/29/97	0.00	8.91	-0.82	0.00	0.00	0.82
06/30/97	0.04	8.79	-0.11	0.00	0.00	0.15
07/01/97	0.08	8.84	0.04	0.00	0.00	0.03
07/02/97	0.00	8.78	-0.06	0.00	0.00	0.06
07/03/97	0.11	8.90	0.12	0.00	0.00	0.00
07/04/97	0.00	8.82	-0.08	0.00	0.00	0.08
07/05/97	0.04	8.63	-0.19	0.00	0.00	0.23
07/06/97	0.09	8.51	-0.12	0.00	0.00	0.20
07/07/97	0.05	8.58	0.07	0.00	0.00	0.00
07/08/97	0.43	8.32	-0.25	0.00	0.00	0.69
07/09/97	0.04	8.34	0.01	0.00	0.00	0.03
07/10/97	0.06	8.27	-0.07	0.00	0.00	0.13
07/11/97	0.03	8.93	0.66	0.00	0.00	0.00
07/12/97	0.09	8.25	-0.68	0.00	0.00	0.76
07/13/97	0.00	8.37	0.12	0.00	0.00	0.00
07/14/97	0.03	8.75	0.37	0.00	0.00	0.00
07/15/97	0.04	8.47	-0.28	0.00	0.00	0.32
07/16/97	0.06	8.27	-0.20	0.00	0.00	0.26
07/17/97	0.00	8.25	-0.02	0.00	0.00	0.02
07/18/97	0.00	8.37	0.12	0.00	0.00	0.00
07/19/97	0.00	8.29	-0.07	0.00	0.00	0.07

07/20/97	0.17	7.96	-0.33	0.00	0.00	0.50
07/21/97	1.75	10.87	2.91	0.04	0.00	0.00
07/22/97	0.00	10.82	-0.05	0.00	0.00	0.05
07/23/97	0.00	10.65	-0.18	0.00	0.00	0.18
07/24/97	0.13	10.64	-0.01	0.00	0.00	0.14
07/25/97	0.00	10.51	-0.13	0.00	0.00	0.13
07/26/97	0.03	10.56	0.05	0.00	0.00	0.00
07/27/97	0.00	10.26	-0.30	0.00	0.00	0.30
07/28/97	0.10	10.41	0.14	0.00	0.00	0.00
07/29/97	0.67	11.23	0.82	0.00	0.00	0.00
07/30/97	0.06	11.14	-0.09	0.01	0.00	0.14
07/31/97	0.05	10.80	-0.34	0.00	0.00	0.39
08/01/97	0.01	10.65	-0.15	0.00	0.00	0.16
08/02/97	0.00	10.65	0.00	0.00	0.00	0.00
08/03/97	0.00	10.45	-0.21	0.00	0.00	0.21
08/04/97	0.00	9.74	-0.71	0.00	0.00	0.71
08/05/97	0.00	10.20	0.46	0.00	0.00	0.00
08/06/97	0.00	9.59	-0.61	0.00	0.00	0.61
08/07/97	0.03	9.35	-0.24	0.00	0.00	0.26
08/08/97	0.00	8.73	-0.62	0.00	0.00	0.62
08/09/97	0.03	9.32	0.59	0.00	0.00	0.00
08/10/97	0.03	8.62	-0.70	0.00	0.00	0.72
08/11/97	0.00	8.48	-0.14	0.00	0.00	0.14
08/12/97	0.00	8.28	-0.20	0.00	0.00	0.20
08/13/97	0.00	8.26	-0.03	0.00	0.00	0.03
08/14/97	0.00	8.17	-0.09	0.00	0.00	0.09
08/15/97	0.09	7.97	-0.19	0.00	0.00	0.28
08/16/97	0.37	7.83	-0.14	0.00	0.00	0.51
08/17/97	0.03	7.80	-0.03	0.00	0.00	0.05
08/18/97	0.00	7.82	0.02	0.00	0.00	0.00
08/19/97	0.05	7.77	-0.06	0.00	0.00	0.11
08/20/97	0.01	7.80	0.03	0.00	0.00	0.00
08/21/97	0.08	7.82	0.02	0.00	0.00	0.06
08/22/97	0.00	7.79	-0.03	0.00	0.00	0.03
08/23/97	0.00	7.82	0.03	0.00	0.00	0.00
08/24/97	0.00	7.77	-0.06	0.00	0.00	0.06
08/25/97	0.01	7.60	-0.16	0.00	0.00	0.17
08/26/97	0.00	7.64	0.03	0.00	0.00	0.00
08/27/97	0.14	7.39	-0.25	0.00	0.00	0.39
08/28/97	0.01	7.49	0.10	0.00	0.00	0.00
08/29/97	0.00	7.67	0.18	0.00	0.00	0.00
08/30/97	0.17	7.60	-0.07	0.00	0.00	0.24
08/31/97	0.00	7.62	0.02	0.00	0.00	0.00
09/01/97	0.00	7.65	0.02	0.00	0.00	0.00
09/02/97	0.00	7.61	-0.04	0.00	0.00	0.04
09/03/97	0.00	7.48	-0.13	0.00	0.00	0.13

09/04/97	0.00	7.27	-0.22	0.00	0.00	0.22
09/05/97	0.00	7.44	0.18	0.00	0.00	0.00
09/06/97	0.00	7.29	-0.15	0.00	0.00	0.15
09/07/97	0.01	7.15	-0.14	0.00	0.00	0.16
09/08/97	0.00	7.23	0.08	0.00	0.00	0.00
09/09/97	0.00	7.18	-0.06	0.00	0.00	0.06
09/10/97	0.04	7.16	-0.01	0.00	0.00	0.05
09/11/97	0.13	7.10	-0.06	0.00	0.00	0.19
09/12/97	0.01	7.09	-0.01	0.00	0.00	0.02
09/13/97	0.04	7.21	0.12	0.00	0.00	0.00
09/14/97	0.00	7.21	0.00	0.00	0.00	0.00
09/15/97	0.09	7.33	0.13	0.00	0.00	0.00
09/16/97	0.03	7.05	-0.29	0.00	0.00	0.31
09/17/97	0.01	7.09	0.04	0.00	0.00	0.00
09/18/97	0.20	7.58	0.50	0.00	0.00	0.00
09/19/97	0.05	7.03	-0.55	0.00	0.00	0.60
09/20/97	0.09	7.36	0.33	0.01	0.00	0.00
09/21/97	0.00	7.30	-0.06	0.00	0.00	0.06
09/22/97	0.00	7.34	0.05	0.00	0.00	0.00
09/23/97	0.04	7.24	-0.11	0.00	0.00	0.14
09/24/97	0.01	7.23	0.00	0.00	0.00	0.02
09/25/97	0.04	7.42	0.19	0.00	0.00	0.00
09/26/97	0.23	7.25	-0.18	0.00	0.00	0.41
09/27/97	0.05	7.00	-0.25	0.00	0.00	0.30
09/28/97	0.15	7.27	0.28	0.00	0.00	0.00
09/29/97	0.00	7.92	0.65	0.00	0.00	0.00
09/30/97	0.00	7.00	-0.93	0.00	0.00	0.93
10/01/97	0.22	7.95	0.95	0.00	0.00	0
10/02/97	0.39	9.76	1.81	0.00	0.00	0
10/03/97	0.19	9.92	0.16	0.00	0.00	0.03
10/04/97	0.10	10.26	0.35	0.00	0.00	0
10/05/97	0.05	10.80	0.53	0.00	0.00	0
10/06/97	0.00	10.48	-0.32	0.00	0.00	.32
10/07/97	0.01	10.31	-0.17	0.00	0.00	.18
10/08/97	0.14	10.59	0.28	0.00	0.00	0
10/09/97	0.29	15.08	4.50	0.00	0.00	0
10/10/97	0.19	15.53	0.45	0.00	0.00	0
10/11/97	0.08	15.51	-0.02	0.00	0.00	0.10
10/12/97	0.05	15.89	0.38	0.00	0.00	0
10/13/97	0.01	15.37	-0.52	0.00	0.00	0.53
10/14/97	0.04	15.36	-0.01	0.00	0.00	0.05
10/15/97	0.05	15.41	0.05	0.00	0.00	0
10/16/97	0.00	14.63	-0.78	0.00	0.00	0.78
10/17/97	0.08	14.18	-0.45	0.00	0.00	0.53
10/18/97	0.00	12.57	-1.61	0.00	0.00	1.61
10/19/97	0.00	11.89	-0.68	0.00	0.00	0.68

10/20/97	0.00	10.60	-1.30	0.00	0.00	1.3
10/21/97	0.03	9.97	-0.62	0.00	0.00	0.65
10/22/97	0.00	10.53	0.55	0.00	0.00	0
10/23/97	0.00	9.39	-1.14	0.00	0.00	1.14
10/24/97	0.05	9.10	-0.29	0.00	0.00	0.34
10/25/97	0.00	8.83	-0.27	0.00	0.00	0.27
10/26/97	0.00	8.54	-0.29	0.00	0.00	0.29
10/27/97	0.00	8.28	-0.26	0.00	0.00	0.26
10/28/97	0.00	8.32	0.04	0.00	0.00	0
10/29/97	0.06	7.79	-0.53	0.00	0.00	0.59
10/30/97	0.10	8.08	0.29	0.00	0.00	0
10/31/97	0.15	16.34	8.26	0.01	0.00	0
11/01/97	0.17	16.79	0.45	0.00	0.00	0.00
11/02/97	0.10	16.64	-0.15	0.00	0.00	0.25
11/03/97	0.05	16.55	-0.09	0.00	0.00	0.14
11/04/97	0.03	17.97	1.42	0.00	0.00	0.00
11/05/97	0.03	18.26	0.29	0.00	0.00	0.00
11/06/97	0.01	18.29	0.02	0.00	0.00	0.00
11/07/97	0.01	18.26	-0.03	0.00	0.00	0.04
11/08/97	0.01	18.02	-0.24	0.00	0.00	0.25
11/09/97	0.01	17.86	-0.16	0.00	0.00	0.17
11/10/97	0.01	17.63	-0.23	0.00	0.00	0.25
11/11/97	0.00	16.37	-1.26	0.00	0.00	1.26
11/12/97	0.00	16.17	-0.20	0.00	0.00	0.20
11/13/97	0.01	14.91	-1.25	0.00	0.00	1.26
11/14/97	0.01	14.17	-0.74	0.00	0.00	0.75
11/15/97	0.00	13.67	-0.51	0.00	0.00	0.51
11/16/97	0.00	12.27	-1.40	0.00	0.00	1.40
11/17/97	0.09	12.30	0.03	0.01	0.09	0.00
11/18/97		13.43	1.12	0.00	0.00	0.00
11/19/97		15.60	2.18	0.00	0.00	0.00
11/20/97		14.69	-0.91	0.00	0.00	0.91
11/21/97	0.01	13.94	-0.75	0.00	0.00	0.77
11/22/97	0.03	12.64	-1.30	0.00	0.00	1.33
11/23/97	0.18	12.22	-0.41	0.00	0.00	0.59
11/24/97	0.00	11.65	-0.57	0.00	0.00	0.57
11/25/97	0.10	11.21	-0.45	0.00	0.00	0.55
11/26/97	0.64	11.22	0.01	0.00	0.00	0.63
11/27/97	0.01	11.19	-0.03	0.00	0.00	0.04
11/28/97	0.19	11.29	0.10	0.00	0.00	0.09
11/29/97	0.58	11.13	-0.16	0.03	0.00	0.71
11/30/97	0.14	11.80	0.67	0.00	0.00	0.00
12/01/97	0.00	11.66	-0.14	0.00	0.00	0.14
12/02/97	0.00	11.61	-0.04	0.00	0.00	0.04
12/03/97	0.00	11.19	-0.43	0.00	0.00	0.43
12/04/97	0.05	10.95	-0.24	0.00	0.00	0.29

12/05/97	0.05	10.84	-0.11	0.00	0.00	0.16
12/06/97	0.17	10.76	-0.08	0.00	0.00	0.25
12/07/97	0.19	11.03	0.27	0.00	0.00	0.00
12/08/97	0.29	10.87	-0.16	0.07	0.00	0.38
12/09/97	0.05	11.13	0.26	0.00	0.00	0.00
12/10/97	0.08	10.91	-0.22	0.00	0.00	0.30
12/11/97	0.01	10.88	-0.03	0.00	0.00	0.04
12/12/97	0.00	10.71	-0.17	0.00	0.00	0.17
12/13/97	0.05	10.75	0.04	0.00	0.00	0.01
12/14/97	0.00	10.60	-0.15	0.00	0.00	0.15
12/15/97	0.06	10.60	0.00	0.00	0.00	0.06
12/16/97	0.01	10.33	-0.26	0.00	0.00	0.28
12/17/97	0.55	10.40	0.07	0.06	0.00	0.42
12/18/97	0.03	13.22	2.82	0.00	0.00	0.00
12/19/97	0.24	14.99	1.78	0.00	0.00	0.00
12/20/97	0.00	15.05	0.06	0.00	0.00	0.00
12/21/97	0.03	15.00	-0.06	0.00	0.00	0.08
12/22/97	0.05	14.72	-0.28	0.00	0.00	0.33
12/23/97	0.11	12.58	-2.13	0.00	0.00	2.25
12/24/97	0.17	12.56	-0.02	0.00	0.00	0.19
12/25/97	0.01	11.79	-0.77	0.00	0.00	0.79
12/26/97	0.04	11.49	-0.30	0.00	0.00	0.34
12/27/97	0.11	11.33	-0.16	0.00	0.00	0.28
12/28/97	0.61	15.58	4.26	0.10	0.00	0.00
12/29/97	0.33	16.03	0.45	0.03	0.00	0.00
12/30/97		0.00	-16.03			16.03
12/31/97		0.00	0.00			0.00
01/01/98	0.00	15.85	15.85	0.00	0.00	0.00
01/02/98	0.00	16.05	0.20	0.00	0.00	0.00
01/03/98	0.00	16.38	0.33	0.00	0.00	0.00
01/04/98	0.06	15.10	-1.28	0.00	0.00	1.35
01/05/98	0.28	16.28	1.18	0.00	0.00	0.00
01/06/98	0.03	18.24	1.96	0.00	0.00	0.00
01/07/98	0.01	18.45	0.21	0.00	0.00	0.00
01/08/98	0.00	18.70	0.25	0.00	0.00	0.00
01/09/98	0.01	18.20	-0.50	0.00	0.00	0.51
01/10/98	0.00	18.08	-0.12	0.00	0.00	0.12
01/11/98	0.00	16.45	-1.63	0.00	0.00	1.63
01/12/98	0.00	15.63	-0.82	0.00	0.00	0.82
01/13/98	0.01	15.41	-0.23	0.00	0.00	0.24
01/14/98	0.00	14.84	-0.56	0.00	0.00	0.56
01/15/98	0.00	14.42	-0.42	0.00	0.00	0.42
01/16/98	0.00	13.79	-0.64	0.00	0.00	0.64
01/17/98	0.14	13.33	-0.46	0.00	0.00	0.60
01/18/98	0.04	13.82	0.49	0.03	0.00	0.00
01/19/98	0.01	14.07	0.25	0.00	0.00	0.00

01/20/98	0.01	13.48	-0.59	0.00	0.00	0.60
01/21/98	0.00	13.43	-0.05	0.00	0.00	0.05
01/22/98	0.01	13.12	-0.31	0.00	0.00	0.32
01/23/98	0.00	12.93	-0.19	0.00	0.00	0.19
01/24/98	0.00	11.48	-1.45	0.00	0.00	1.45
01/25/98	0.04	11.17	-0.31	0.00	0.00	0.35
01/26/98	0.00	10.89	-0.27	0.00	0.00	0.27
01/27/98	0.10	10.44	-0.45	0.00	0.00	0.55
01/28/98	0.01	10.15	-0.29	0.00	0.00	0.31
01/29/98	0.00	9.93	-0.22	0.00	0.00	0.22
01/30/98	0.00	9.94	0.01	0.00	0.00	0.00
01/31/98	0.00	9.26	-0.68	0.00	0.00	0.68
02/01/98	0.22	9.90	0.64	0.00	0.00	0.00
02/02/98	0.01	9.48	-0.42	0.00	0.00	0.43
02/03/98	0.00	9.30	-0.17	0.03	0.00	0.14
02/04/98	0.04	9.22	-0.08	0.00	0.00	0.12
02/05/98	0.00	9.10	-0.13	0.00	0.00	0.13
02/06/98	0.00	8.86	-0.23	0.00	0.00	0.23
02/07/98	0.00	9.04	0.17	0.00	0.00	0.00
02/08/98	0.00	8.74	-0.30	0.00	0.00	0.30
02/09/98	0.00	8.53	-0.21	0.00	0.00	0.21
02/10/98	0.00	8.60	0.07	0.00	0.00	0.00
02/11/98	0.00	8.37	-0.23	0.00	0.00	0.23
02/12/98	0.00	8.38	0.01	0.00	0.00	0.00
02/13/98	0.05	8.17	-0.21	0.00	0.00	0.26
02/14/98	0.03	8.27	0.09	0.00	0.00	0.00
02/15/98	0.00	8.38	0.11	0.00	0.00	0.00
02/16/98	0.00	8.22	-0.16	0.00	0.00	0.16
02/17/98	0.00			0.00	0.00	0.00
02/18/98	0.00	7.97	-0.26	0.00	0.00	0.26
02/19/98	0.00	7.93	-0.03	0.00	0.00	0.03
02/20/98	0.00	7.52	-0.41	0.00	0.00	0.41
02/21/98	0.00	7.28	-0.24	0.00	0.00	0.24
02/22/98	0.04	7.12	-0.16	0.00	0.00	0.20
02/23/98	0.00	6.82	-0.30	0.00	0.00	0.30
02/24/98	0.03	7.10	0.28	0.00	0.00	0.00
02/25/98	0.00	7.07	-0.03	0.00	0.00	0.03
02/26/98	0.00	7.71	0.65	0.00	0.00	0.00
02/27/98	0.00	7.06	-0.65	0.00	0.00	0.65
02/28/98	0.00	0.00	-7.06	0.00	0.00	7.06
03/01/98	0.13	6.95	6.95	0.00	0.00	0.00
03/02/98	0.03	7.12	0.17	0.00	0.00	0.00
03/03/98	0.01	7.46	0.33	0.00	0.00	0.00
03/04/98	0.00	7.68	0.23	0.00	0.00	0.00
03/05/98	0.00	7.87	0.19	0.00	0.00	0.00
03/06/98	0.00	7.69	-0.18	0.00	0.00	0.18

03/07/98	0.00	7.09	-0.60	0.00	0.00	0.60
03/08/98	0.05	7.65	0.56	0.00	0.00	0.00
03/09/98	0.00	7.33	-0.32	0.00	0.00	0.32
03/10/98	0.00	6.91	-0.42	0.00	0.00	0.42
03/11/98	0.00	7.00	0.10	0.00	0.00	0.00
03/12/98	0.00	6.93	-0.07	0.00	0.00	0.07
03/13/98	0.00	6.86	-0.07	0.00	0.00	0.07
03/14/98	0.00	7.11	0.25	0.00	0.00	0.00
03/15/98	0.00	6.82	-0.29	0.00	0.00	0.29
03/16/98	0.20	6.88	0.06	0.00	0.00	0.14
03/17/98	0.00	6.54	-0.34	0.00	0.00	0.34
03/18/98	0.00	6.83	0.28	0.00	0.00	0.00
03/19/98	0.00	6.65	-0.17	0.00	0.00	0.17
03/20/98	0.00	6.75	0.09	0.00	0.00	0.00
03/21/98	0.04	6.50	-0.25	0.00	0.00	0.29
03/22/98	0.08	6.43	-0.06	0.00	0.00	0.14
03/23/98	0.00	6.22	-0.22	0.00	0.00	0.22
03/24/98	0.06	6.19	-0.03	0.00	0.00	0.09
03/25/98	0.04	6.19	0.00	0.00	0.00	0.03
03/26/98	0.14	6.36	0.16	0.00	0.00	0.00
03/27/98	0.00	6.44	0.08	0.00	0.00	0.00
03/28/98	0.00	6.18	-0.26	0.00	0.00	0.26
03/29/98	0.09	6.37	0.20	0.00	0.00	0.00
03/30/98	0.00	6.37	0.00	0.00	0.00	0.00

APPENDIX R (Cont.)

WEEKLY WATER BALANCE ON 20% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff	Percolation (L)	ET
07/24/97	0.38	10.60	-0.90	0.00	0.00	1.28
07/31/97	0.18	10.11	-0.50	0.00	0.00	0.00
08/08/97	0.11	9.38	-0.72	0.00	0.00	0.84
08/16/97	1.03	8.83	-0.55	0.00	0.00	1.58
08/24/98	0.00		-8.83	0.00	0.00	8.83
08/31/98	2.22	8.42	8.42	0.00	0.00	0.00
09/08/98	2.11	13.15	4.73	0.00	0.00	0.00
09/16/98	0.39	12.00	-1.15	0.00	0.00	1.55
09/23/98	0.32	10.71	-1.29	0.00	0.00	1.61
09/30/98	0.24	9.40	-1.30	0.06	0.02	1.47
10/08/98	0.06	7.96	-1.44	0.00	0.00	1.51
10/16/98	0.37	7.96	0.00	0.00	0.00	0.37
10/24/98	0.56	8.73	0.77	0.00	0.00	0.00
10/31/98	0.03	8.61	-0.12	0.00	0.00	0.00
11/08/98	15.68	11.91	3.30	3.52	0.09	8.77
11/16/98	21.49	24.18	12.26	6.61	1.74	0.00
11/23/98	1.24	30.52	6.34	0.25	0.14	0.00
11/30/98	0.06	23.55	-6.97	0.00	0.00	7.03
12/08/98	0.90	24.31	0.75	0.00	0.00	0.15
12/16/98	1.32	25.40	1.09	0.05	0.00	0.18
12/24/98	1.09	20.66	-4.74	0.05	0.00	5.78
12/31/98	2.32	22.63	1.97	0.20	0.00	0.00
01/08/98	4.23	23.78	1.14	1.70	0.24	1.14
01/16/98	0.58	23.32	-0.45	0.00	0.00	1.04
01/24/98	6.65	23.14	-0.18	1.92	0.00	4.92
01/31/98	1.14	22.94	-0.20	0.05	0.00	1.29
02/07/98	0.05	22.61	-0.34	0.00	0.00	0.39
02/14/98	0.03	20.02	-2.58	0.00	0.00	2.61
02/21/98	0.24	13.28	-6.75	0.00	0.00	6.99
02/28/98	0.98	14.02	0.75	0.00	0.00	0.00
03/08/98	0.86	14.17	0.14	0.03	0.00	0.68
03/16/98	0.60	15.88	1.71	0.27	0.00	0.00
03/24/98	0.15	22.45	6.57	0.79	0.00	0.00
03/31/98	3.29	18.96	-3.49	0.07	0.16	6.54
04/08/98	4.85	23.30	4.34	0.43	0.00	0.00
04/16/98	0.10	17.08	-6.22	0.00	0.00	6.32
04/23/98	0.00	7.01	-10.07	0.00	0.00	10.07
04/30/98	0.06	13.55	6.53	0.00	0.00	0.00
05/08/98	3.02	16.18	2.64	0.74	0.00	0.00
05/16/98	1.14	21.64	5.45	0.04	0.00	0.00
05/24/98	0.29	20.18	-1.46	0.04	0.00	1.71

05/31/98	0.00	15.11	-5.07	0.00	0.00	5.07
06/08/98	0.53	12.55	-2.55	0.00	0.00	3.09
06/16/98	0.61	11.39	-1.17	0.00	0.00	1.78
06/23/98	0.57	10.53	-0.85	0.00	0.00	1.43
06/30/98	0.57	9.41	-1.12	0.00	0.00	1.69
07/08/98	0.80	8.67	-0.74	0.00	0.00	1.54
07/16/98	0.34	8.46	-0.22	0.00	0.00	0.56
07/24/98	2.04	9.48	1.03	0.00	0.00	1.02
07/31/98	0.91	10.70	1.22	0.00	0.00	0.00
08/08/98	0.04	9.92	-0.78	0.00	0.00	0.82
08/16/98	0.51	8.37	-1.55	0.00	0.00	2.06
08/24/98	0.17	7.80	-0.57	0.00	0.00	0.73
08/31/98	0.33	7.58	-0.22	0.00	0.00	0.55
09/08/98	0.01	7.39	-0.19	0.00	0.00	0.20
09/16/98	0.33	7.17	-0.22	0.00	0.00	0.56
09/23/98	0.39	7.28	0.11	0.00	0.00	0.28
09/30/98	0.48	7.30	0.02	0.00	0.00	0.46
10/08/98	1.10	10.01	2.71	0.00	0.00	0.00
10/16/98	0.71	15.35	5.34	0.00	0.00	0.00
10/24/98	0.15	11.03	-4.32	0.00	0.00	4.47
10/31/98	0.32	9.45	-1.57	0.00	0.00	1.89
11/08/98	0.41	17.60	8.14	0.00	0.00	0.00
11/16/98	0.05	15.38	-2.22	0.00	0.00	2.27
11/23/98	0.30	15.80	0.42	0.00	0.00	0.00
11/30/98	1.66	11.28	-4.52	0.00	0.00	6.19
12/08/98	0.75	11.11	-0.17	0.04	0.00	0.88
12/16/98	0.27	10.74	-0.37	0.00	0.00	0.64
12/24/98	1.17	13.71	2.97	0.06	0.00	0.00
12/31/98	1.10	13.13	-0.58	0.13	0.00	1.55
01/08/98	0.38	16.88	3.75	0.00	0.00	0.00
01/15/98	0.03	16.15	-0.73	0.00	0.00	0.76
01/23/98	0.22	13.50	-2.65	0.03	0.00	2.84
01/31/98	0.15	10.41	-3.09	0.00	0.00	3.24
02/07/98	0.27	9.27	-1.14	0.03	0.00	1.37
02/14/98	0.08	8.44	-0.83	0.00	0.00	0.91
02/21/98	0.00	7.88	-0.55	0.00	0.00	0.55
02/28/98	0.06	5.36	-2.53	0.00	0.00	2.59
03/08/98	0.22	7.44	2.08	0.00	0.00	0.00
03/16/98	0.20	6.98	-0.46	0.00	0.00	0.66
03/23/98	0.11	6.56	-0.42	0.00	0.00	0.53
03/30/98	0.33	6.30	-0.26	0.00	0.00	0.59

APPENDIX R (Cont.)

MONTHLY WATER BALANCE ON 20% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
07/31/96	0.56	10.35	-1.00	0.00	0.01	1.55
08/31/96	3.37	8.88	-1.48	0.00	0.00	4.84
09/30/96	3.06	11.31	2.44	0.06	0.00	0.57
10/31/96	1.02	8.32	-3.00	0.00	0.00	4.01
11/30/96	38.48	22.54	14.23	10.38	1.98	11.90
12/31/96	5.64	23.25	0.71	0.29	0.00	4.63
01/31/97	12.61	23.30	0.04	3.67	0.24	8.66
02/28/97	1.30	17.48	-5.81	0.00	0.00	7.11
03/31/97	4.90	17.87	0.38	1.17	0.00	3.35
04/30/97	5.02	15.24	-2.63	0.43	0.00	7.21
05/31/97	4.46	18.28	3.04	0.81	0.00	0.60
06/30/97	2.29	10.97	-7.31	0.00	0.00	9.59
07/31/97	4.10	9.33	-1.64	0.00	0.00	5.75
08/31/97	1.04	8.41	-0.91	0.00	0.00	1.95
09/30/97	1.22	7.28	-1.13	0.00	0.00	2.35
10/31/97	2.29	11.46	4.18	0.00	0.00	0.00
11/30/97	2.43	15.02	3.56	0.00	0.09	0.00
12/31/97	3.29	12.17	-2.84	0.23	0.00	5.90
01/31/98	0.77	14.23	2.06	0.03	0.00	0.00
02/28/98	0.41	7.74	-6.50	0.03	0.00	6.87
03/31/98	0.86	6.82	-0.92	0.00	0.00	1.78

APPENDIX S. Daily, weekly, and monthly water balance on 40% IC plots at MCBH

DAILY WATER BALANCE ON 40% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
07/19/96	0.03	8.70			0.00	0.03
07/20/96	0.00	8.19	-0.52		0.00	0.52
07/21/96	0.00	7.98	-0.21		0.00	0.21
07/22/96	0.36	8.20	0.22		0.00	0.13
07/23/96	0.00	8.22	0.01		0.00	0.00
07/24/96	0.00	7.84	-0.37		0.00	0.37
07/25/96	0.00				0.00	0.00
07/26/96	0.00	7.77	-0.07		0.00	0.07
07/27/96	0.18				0.00	0.18
07/28/96	0.00				0.00	0.00
07/29/96	0.00	7.33	-0.44		0.00	0.44
07/30/96	0.00	7.65	0.31		0.00	0.00
07/31/96						0.00
08/01/96	0.04	6.74	-0.91	0.00	0.00	0.95
08/02/96	0.00	6.59	-0.14	0.00	0.00	0.14
08/03/96	0.00	6.76	0.17	0.00	0.00	0.00
08/04/96	0.03	6.63	-0.13	0.00	0.00	0.16
08/05/96	0.00	6.44	-0.19	0.00	0.00	0.19
08/06/96	0.04	6.37	-0.07	0.00	0.00	0.10
08/07/96	0.01	6.42	0.04	0.00	0.00	0.00
08/08/96	0.00	6.19	-0.23	0.00	0.00	0.23
08/09/96	0.09	6.15	-0.04	0.00	0.00	0.12
08/10/96	0.05	5.69	-0.46	0.00	0.00	0.51
08/11/96	0.56			0.00	0.00	0.56
08/12/96	0.00	0.00	-5.69	0.00	0.00	5.69
08/13/96	0.33	10.50	10.50	0.00	0.00	0.00
08/14/96	0.00	9.95	-0.55	0.00	0.00	0.55
08/15/96	0.00	8.28	-1.67	0.00	0.00	1.67
08/16/96						
08/17/96						
08/18/96						
08/19/96						
08/20/96						
08/21/96						
08/22/96						
08/23/96						
08/24/96						
08/25/96						
08/26/96	0.00	5.48	-2.79	0.00	0.00	2.79
08/27/96	0.05	5.68	0.20	0.00	0.00	0.00
08/28/96	0.00			0.00	0.00	0.00
08/29/96	0.00	5.72	0.04	0.00	0.00	0.00

08/30/96	0.14	5.29	-0.43	0.00	0.00	0.57
08/31/96	2.03	10.23	4.94	0.10	0.00	0.00
09/01/96	0.00	12.13	1.91	0.02	0.00	0.00
09/02/96	0.00	12.11	-0.03	0.00	0.00	0.03
09/03/96	0.00	11.57	-0.53	0.00	0.00	0.53
09/04/96	0.30	11.32	-0.25	0.00	0.00	0.55
09/05/96	0.71	12.48	1.16	0.02	0.00	0.00
09/06/96	0.46	12.15	-0.33	0.00	0.00	0.79
09/07/96	0.20			0.00	0.00	0.20
09/08/96	0.43	12.22	0.07	0.02	0.00	0.33
09/09/96	0.00			0.00	0.00	0.00
09/10/96	0.01	11.12	-1.10	0.00	0.00	1.11
09/11/96	0.25			0.00	0.00	0.25
09/12/96	0.05			0.00	0.00	0.05
09/13/96	0.00	10.11	-1.01	0.00	0.00	1.01
09/14/96	0.00	9.88	-0.22	0.00	0.00	0.22
09/15/96	0.08	7.76	-2.12	0.00	0.00	2.20
09/16/96	0.00	7.70	-0.06	0.00	0.00	0.06
09/17/96	0.00	7.57	-0.12	0.00	0.00	0.12
09/18/96	0.00	7.21	-0.36	0.00	0.00	0.36
09/19/96	0.19	7.21	0.00	0.00	0.00	0.20
09/20/96	0.13	7.70	0.49	0.00	0.00	0.00
09/21/96	0.00	6.93	-0.77	0.00	0.00	0.77
09/22/96	0.00	6.78	-0.15	0.00	0.00	0.15
09/23/96	0.00	6.67	-0.11	0.00	0.00	0.11
09/24/96	0.24	6.44	-0.24	0.00	0.00	0.47
09/25/96		8.67	2.23			
09/26/96		6.69	-1.98			
09/27/96		6.48	-0.21			
09/28/96		6.04	-0.44			
09/29/96		6.25	0.20			
09/30/96	0.00	6.12	-0.13	0.00	0.00	0.13
10/01/96	0.00	5.97	-0.15	0.00	0.00	0.15
10/02/96	0.00	5.78	-0.19	0.00	0.00	0.19
10/03/96	0.00	5.68	-0.09	0.00	0.00	0.09
10/04/96	0.00	5.80	0.12	0.00	0.00	0.00
10/05/96	0.00	6.71	0.91	0.00	0.00	0.00
10/06/96	0.00			0.00	0.00	0.00
10/07/96	0.06	6.89	0.18	0.00	0.00	0.00
10/08/96	0.00	5.82	-1.06	0.00	0.00	1.06
10/09/96	0.00	6.52	0.69	0.00	0.00	0.00
10/10/96	0.05	6.47	-0.04	0.00	0.00	0.09
10/11/96	0.00	6.62	0.15	0.00	0.00	0.00
10/12/96	0.00	5.96	-0.66	0.00	0.00	0.66
10/13/96	0.00	6.43	0.46	0.00	0.00	0.00
10/14/96	0.04	6.04	-0.39	0.00	0.00	0.43
10/15/96	0.17	6.19	0.15	0.00	0.00	0.02

10/16/96	0.11	6.23	0.04	0.00	0.00	0.07
10/17/96	0.00	5.70	-0.53	0.00	0.00	0.53
10/18/96	0.00	5.81	0.11	0.00	0.00	0.00
10/19/96	0.41	5.74	-0.07	0.00	0.00	0.48
10/20/96	0.14	6.01	0.27	0.00	0.00	0.00
10/21/96	0.00	6.98	0.97	0.00	0.00	0.00
10/22/96	0.00	7.33	0.35	0.00	0.00	0.00
10/23/96	0.01	5.86	-1.47	0.00	0.00	1.48
10/24/96	0.00	6.02	0.16	0.00	0.00	0.00
10/25/96	0.00	6.01	-0.01	0.00	0.00	0.01
10/26/96	0.00	5.85	-0.16	0.00	0.00	0.16
10/27/96	0.00	6.05	0.20	0.00	0.00	0.00
10/28/96	0.00	5.63	-0.41	0.00	0.00	0.41
10/29/96	0.03	5.61	-0.02	0.00	0.00	0.05
10/30/96	0.00	5.44	-0.17	0.00	0.00	0.17
10/31/96	0.00			0.00	0.00	0.00
11/01/96	0.00	5.57	0.13	0.00	0.00	0.00
11/02/96	0.27	5.49	-0.08	0.00	0.00	0.34
11/03/96	0.00	5.21	-0.28	0.00	0.00	0.28
11/04/96	0.00	5.74	0.53	0.00	0.00	0.00
11/05/96	11.91	5.16	-0.58	4.47	0.39	7.63
11/06/96	0.05	8.15	2.99	0.00	0.00	0.00
11/07/96	0.06	20.75	12.60	0.00	0.00	0.00
11/08/96	3.39	20.45	-0.30	0.29	0.05	3.36
11/09/96	0.00	22.02	1.58	0.00	0.00	0.00
11/10/96	0.01	21.06	-0.96	0.00	0.01	0.97
11/11/96	0.01	20.99	-0.07	0.00	0.01	0.08
11/12/96	5.65	21.05	0.07	0.93	0.16	4.50
11/13/96	2.81	21.54	0.49	0.98	0.05	1.29
11/14/96	5.54	22.72	1.18	1.17	0.12	3.07
11/15/96	1.68	23.42	0.69	0.09	0.01	0.88
11/16/96	5.79			2.29	0.14	3.35
11/17/96	1.12	22.76	-0.66	0.26	0.23	1.28
11/18/96	0.11	23.42	0.67	0.00	0.05	0.00
11/19/96	0.00					0.00
11/20/96	0.00			0.00	0.16	0.00
11/21/96	0.00	22.12	-1.30	0.00	0.01	1.29
11/22/96	0.01	22.16	0.04	0.00	0.00	0.00
11/23/96	0.00	21.55	-0.61	0.00	0.00	0.61
11/24/96	0.04	21.37	-0.18	0.00	0.00	0.21
11/25/96	0.00			0.00	0.00	0.00
11/26/96	0.00	21.10	-0.27	0.00	0.00	0.27
11/27/96	0.00	20.63	-0.48	0.00	0.02	0.45
11/28/96	0.03	20.30	-0.32	0.00	0.00	0.35
11/29/96	0.00	20.33	0.03	0.00	0.01	0.00
11/30/96	0.00	20.07	-0.26	0.00	0.00	0.26
12/01/96	0.00	19.43	-0.65	0.00	0.00	0.65

12/02/96	0.00	19.38	-0.05	0.08	0.14	0.00
12/03/96	0.28			0.00	0.00	0.28
12/04/96	0.05	18.75	-0.63	0.00	0.00	0.68
12/05/96	0.09	18.42	-0.33	0.00	0.00	0.42
12/06/96	0.01	17.96	-0.47	0.00	0.00	0.47
12/07/96	0.43	17.84	-0.12	0.00	0.00	0.55
12/08/96	0.04	17.75	-0.09	0.00	0.01	0.13
12/09/96	0.00			0.00	0.00	0.00
12/10/96	0.09	17.18	-0.57	0.00	0.00	0.66
12/11/96	0.32	17.63	0.45	0.00	0.02	0.00
12/12/96	0.05	17.53	-0.10	0.00	0.00	0.15
12/13/96	0.10	17.34	-0.19	0.00	0.00	0.29
12/14/96	0.74			0.05	0.00	0.69
12/15/96	0.03			0.00	0.00	0.03
12/16/96	0.00	18.08	0.74	0.00	0.00	0.00
12/17/96	0.00			0.00	0.00	0.00
12/18/96	0.00	17.34	-0.73	0.00	0.00	0.73
12/19/96	0.00	17.08	-0.26	0.00	0.00	0.26
12/20/96	0.00	17.09	0.00	0.00	0.00	0.00
12/21/96	0.17			0.00	0.00	0.16
12/22/96	0.25	17.33	0.24	0.06	0.00	0.00
12/23/96	0.47	17.65	0.32	0.02	0.00	0.13
12/24/96	0.20	18.11	0.46	0.00	0.00	0.00
12/25/96	0.00			0.00	0.00	0.00
12/26/96	0.34	17.87	-0.25	0.00	0.00	0.59
12/27/96	1.03	21.45	3.58	0.20	0.00	0.00
12/28/96	0.43	20.79	-0.66	0.00	0.00	1.09
12/29/96	0.00	19.90	-1.54	0.00	0.00	1.54
12/30/96	0.04			0.00	0.00	0.04
12/31/96	0.48			0.05	0.00	0.44
01/01/97	0.33			0.00	0.00	0.33
01/02/97	0.00			0.00	0.00	0.00
01/03/97	0.18	21.00	1.09	2.49	0.02	0.00
01/04/97	3.06	22.99	2.00	0.05	0.01	1.01
01/05/97	0.24	21.88	-1.11	0.01	0.02	1.31
01/06/97	0.15			0.00	0.01	0.14
01/07/97	0.13	21.22	-0.67	0.00	0.00	0.79
01/08/97	0.14	21.06	-0.15	0.00	0.00	0.29
01/09/97	0.15	21.08	0.02	0.00	0.00	0.13
01/10/97	0.20	20.77	-0.31	0.00	0.00	0.51
01/11/97	0.23			0.00	0.03	0.20
01/12/97		20.09	-0.68	0.00	0.00	0.68
01/13/97		21.62	1.53	0.00	0.00	0.00
01/14/97		21.15	-0.47	0.00	0.00	0.47
01/15/97		20.90	-0.25	0.00	0.00	0.25
01/16/97		22.68	1.78	0.00	0.00	0.00
01/17/97	0.00	21.25	-1.43	0.00	0.00	1.43

01/18/97	0.00	20.73	-0.51	0.00	0.00	0.51
01/19/97	5.51	20.69	-0.05	2.62	0.00	2.94
01/20/97	0.06	22.23	1.54	0.00	0.03	0.00
01/21/97	1.08	21.80	-0.43	0.19	0.07	1.25
01/22/97	0.00	22.15	0.35	0.00	0.03	0.00
01/23/97	0.00	21.47	-0.68	0.00	0.00	0.68
01/24/97	0.00	21.22	-0.25	0.00	0.00	0.25
01/25/97	0.00	20.96	-0.26	0.00	0.00	0.26
01/26/97	0.00	20.83	-0.13	0.00	0.00	0.13
01/27/97	0.00	20.95	0.12	0.00	0.00	0.00
01/28/97	0.04	20.94	-0.01	0.00	0.00	0.04
01/29/97	0.89	21.14	0.20	0.05	0.00	0.64
01/30/97	0.11	21.70	0.56	0.00	0.00	0.00
01/31/97	0.10	21.44	-0.26	0.00	0.00	0.36
02/01/97	0.00	21.31	-0.13	0.00	0.00	0.13
02/02/97	0.05	21.19	-0.12	0.00	0.00	0.17
02/03/97	0.00			0.00	0.00	0.00
02/04/97	0.00	0.00	-21.19	0.00	0.00	21.19
02/05/97	0.00	20.62	-0.58	0.00	0.00	0.57
02/06/97	0.00	20.22	-0.40	0.00	0.00	0.40
02/07/97	0.00	19.72	-0.50	0.00	0.00	0.50
02/08/97	0.00	19.42	-0.30	0.00	0.00	0.30
02/09/97	0.00	19.11	-0.31	0.00	0.00	0.31
02/10/97	0.03	18.60	-0.51	0.00	0.00	0.54
02/11/97	0.00	18.14	-0.46	0.00	0.00	0.46
02/12/97	0.00	17.38	-0.77	0.00	0.00	0.77
02/13/97	0.00	16.83	-0.55	0.00	0.00	0.55
02/14/97	0.00	16.41	-0.42	0.00	0.00	0.42
02/15/97	0.00			0.00	0.00	0.00
02/16/97	0.00	15.60	-0.81	0.00	0.00	0.81
02/17/97	0.00	15.35	-0.25	0.00	0.00	0.25
02/18/97	0.00	15.09	-0.26	0.00	0.00	0.26
02/19/97	0.00	14.83	-0.26	0.00	0.00	0.26
02/20/97	0.00	14.09	-0.74	0.00	0.00	0.74
02/21/97	0.24	13.80	-0.29	0.00	0.00	0.53
02/22/97	0.38	13.79	-0.01	0.00	0.00	0.39
02/23/97	0.04	13.77	-0.02	0.00	0.00	0.06
02/24/97	0.00	13.33	-0.44	0.00	0.00	0.44
02/25/97	0.18	13.21	-0.12	0.00	0.00	0.30
02/26/97	0.28	13.02	-0.19	0.00	0.00	0.47
02/27/97	0.08	13.04	0.02	0.00	0.00	0.05
02/28/97	0.03	13.69	0.64	0.00	0.00	0.00
03/01/97	0.15			0.00	0.00	0.15
03/02/97	0.06	13.11	-0.58	0.00	0.00	0.64
03/03/97	0.00	12.91	-0.20	0.00	0.00	0.20
03/04/97	0.28	12.83	-0.08	0.00	0.00	0.36
03/05/97	0.28	14.27	1.44	0.00	0.00	0.00

03/06/97	0.08	14.57	0.30	0.00	0.00	0.00
03/07/97	0.01	14.03	-0.54	0.03	0.00	0.52
03/08/97	0.00	13.74	-0.29	0.00	0.00	0.29
03/09/97	0.04	13.63	-0.10	0.00	0.00	0.14
03/10/97	0.01	13.28	-0.36	0.00	0.00	0.37
03/11/97	0.36	17.30	4.02	0.21	0.00	0.00
03/12/97	0.06	17.44	0.14	0.00	0.00	0.00
03/13/97	0.03	18.78	1.35	0.05	0.00	0.00
03/14/97	0.05	18.88	0.10	0.00	0.00	0.00
03/15/97	0.04	19.09	0.21	0.00	0.00	0.00
03/16/97	0.01	18.82	-0.27	0.00	0.00	0.28
03/17/97	0.01	21.97	3.15	1.14	0.00	0.00
03/18/97	0.04	20.57	-1.40	0.00	0.00	1.44
03/19/97	0.04	20.13	-0.44	0.00	0.00	0.48
03/20/97	0.01	20.10	-0.03	0.00	0.00	0.04
03/21/97	0.01	19.52	-0.58	0.00	0.00	0.59
03/22/97	0.01	19.25	-0.27	0.00	0.00	0.29
03/23/97	0.01	21.84	2.59	0.07	0.03	0.00
03/24/97	0.01			0.00	0.03	0.00
03/25/97	1.22			0.00	0.03	1.19
03/26/97	0.01	21.36	-0.49	0.00	0.00	0.50
03/27/97	0.15	20.95	-0.40	0.00	0.00	0.56
03/28/97	0.04	20.91	-0.04	0.00	0.00	0.08
03/29/97	0.00	20.32	-0.59	0.00	0.00	0.59
03/30/97	0.00	20.01	-0.31	0.00	0.00	0.31
03/31/97	1.87	19.94	-0.07	0.11	0.25	1.57
04/01/97	3.07	23.96	4.02	0.42	0.13	0.00
04/02/97	1.24	22.37	-1.59	0.47	0.10	2.26
04/03/97	0.00	21.84	-0.53	0.00	0.00	0.53
04/04/97	0.47	21.59	-0.25	0.00	0.00	0.72
04/05/97	0.03	21.72	0.13	0.00	0.00	0.00
04/06/97	0.00	21.37	-0.34	0.00	0.00	0.34
04/07/97	0.04	21.09	-0.28	0.00	0.00	0.32
04/08/97	0.00	21.12	0.03	0.00	0.00	0.00
04/09/97	0.08	20.30	-0.83	0.00	0.00	0.90
04/10/97	0.03	20.03	-0.26	0.00	0.00	0.29
04/11/97	0.00	19.44	-0.59	0.00	0.00	0.59
04/12/97	0.00	18.82	-0.63	0.00	0.00	0.63
04/13/97	0.00	18.35	-0.47	0.00	0.00	0.47
04/14/97	0.00	17.93	-0.42	0.00	0.00	0.42
04/15/97	0.00	17.47	-0.46	0.00	0.00	0.46
04/16/97	0.00	16.79	-0.68	0.00	0.00	0.68
04/17/97	0.00	16.37	-0.42	0.00	0.00	0.42
04/18/97	0.00	15.55	-0.82	0.00	0.00	0.82
04/19/97	0.00	15.82	0.27	0.00	0.00	0.00
04/20/97	0.00	15.04	-0.78	0.00	0.00	0.78

04/21/97	0.00	14.64	-0.40	0.00	0.00	0.40
04/22/97	0.00	14.37	-0.27	0.00	0.00	0.27
04/23/97	0.00			0.00	0.00	0.00
04/24/97	0.00			0.00	0.00	0.00
04/25/97	0.00			0.00	0.00	0.00
04/26/97	0.00			0.00	0.00	0.00
04/27/97	0.04	13.18	-1.19	0.00	0.00	1.23
04/28/97	0.03	13.08	-0.10	0.00	0.00	0.13
04/29/97	0.00	12.96	-0.12	0.00	0.00	0.12
04/30/97	0.00	12.73	-0.23	0.00	0.00	0.23
05/01/97	0.00	12.15	-0.59	0.00	0.00	0.59
05/02/97	0.04	11.86	-0.29	0.00	0.00	0.32
05/03/97	0.00	10.38	-1.48	0.00	0.00	1.48
05/04/97	0.20	11.77	1.39	0.00	0.00	0.00
05/05/97	1.64	11.00	-0.77	0.54	0.00	1.87
05/06/97	0.99	21.45	10.46	0.72	0.03	0.00
05/07/97	0.14	20.82	-0.63	0.00	0.00	0.77
05/08/97	0.01	20.51	-0.30	0.00	0.00	0.32
05/09/97	0.01	20.22	-0.29	0.00	0.00	0.30
05/10/97	0.23	20.05	-0.17	0.00	0.00	0.40
05/11/97	0.00	19.80	-0.25	0.00	0.00	0.25
05/12/97	0.01	19.45	-0.35	0.00	0.00	0.36
05/13/97	0.32	19.83	0.38	0.00	0.00	0.00
05/14/97	0.04	19.60	-0.23	0.00	0.00	0.27
05/15/97	0.43	20.32	0.73	0.03	0.00	0.00
05/16/97	0.10	19.69	-0.63	0.00	0.00	0.73
05/17/97	0.00	19.50	-0.20	0.00	0.00	0.20
05/18/97	0.01	19.11	-0.39	0.00	0.00	0.40
05/19/97	0.00	18.40	-0.71	0.00	0.00	0.71
05/20/97	0.00	17.30	-1.10	0.00	0.00	1.10
05/21/97	0.20	16.41	-0.89	0.00	0.00	1.09
05/22/97	0.06	16.27	-0.14	0.00	0.00	0.20
05/23/97	0.01	15.86	-0.41	0.00	0.00	0.42
05/24/97	0.00	15.36	-0.50	0.00	0.00	0.50
05/25/97	0.00	14.92	-0.45	0.00	0.00	0.45
05/26/97	0.00	14.38	-0.54	0.00	0.00	0.54
05/27/97	0.00					0.00
05/28/97						0.00
05/29/97		13.27	-1.11			1.11
05/30/97		12.87	-0.40			0.40
05/31/97		12.49	-0.38			0.38
06/01/97		12.34	-0.15			0.15
06/02/97	0.00	11.38	-0.96	0.00	0.00	0.96

06/03/97	0.37	12.90	1.52	0.00	0.00	0.00
06/04/97	0.14	12.77	-0.13	0.00	0.00	0.27
06/05/97	0.01	11.89	-0.88	0.00	0.00	0.89
06/06/97	0.00	11.70	-0.19	0.00	0.00	0.19
06/07/97	0.01	12.45	0.75	0.00	0.00	0.00
06/08/97	0.00	12.42	-0.03	0.00	0.00	0.03
06/09/97	0.01	12.30	-0.12	0.00	0.00	0.13
06/10/97	0.36	12.35	0.05	0.00	0.00	0.31
06/11/97	0.05	12.33	-0.02	0.00	0.00	0.07
06/12/97	0.04	10.55	-1.79	0.00	0.00	1.82
06/13/97	0.01	11.18	0.63	0.00	0.00	0.00
06/14/97	0.10	10.99	-0.19	0.00	0.00	0.29
06/15/97	0.00	9.33	-1.65	0.00	0.00	1.65
06/16/97	0.04	9.68	0.35	0.00	0.00	0.00
06/17/97	0.13	10.66	0.98	0.00	0.00	0.00
06/18/97	0.00	10.61	-0.05	0.00	0.00	0.05
06/19/97	0.00	10.75	0.14	0.00	0.00	0.00
06/20/97	0.22	10.54	-0.21	0.00	0.00	0.42
06/21/97	0.00	8.74	-1.80	0.00	0.00	1.80
06/22/97	0.14	8.64	-0.11	0.00	0.00	0.25
06/23/97	0.09	8.74	0.11	0.00	0.00	0.00
06/24/97	0.00	9.87	1.13	0.00	0.00	0.00
06/25/97	0.14			0.00	0.00	0.14
06/26/97	0.00	9.35	-0.52	0.00	0.00	0.52
06/27/97	0.09	9.08	-0.26	0.00	0.00	0.35
06/28/97	0.30	9.34	0.26	0.00	0.00	0.05
06/29/97	0.00	10.16	0.82	0.00	0.00	0.00
06/30/97	0.04	8.19	-1.97	0.00	0.00	2.01
07/01/97	0.08	7.63	-0.56	0.00	0.00	0.63
07/02/97	0.00	7.55	-0.09	0.00	0.00	0.09
07/03/97	0.11	7.69	0.14	0.00	0.00	0.00
07/04/97	0.00	8.11	0.42	0.00	0.00	0.00
07/05/97	0.04	9.72	1.61	0.00	0.00	0.00
07/06/97	0.09	9.39	-0.33	0.00	0.00	0.42
07/07/97	0.05	9.34	-0.05	0.00	0.00	0.10
07/08/97	0.43	7.87	-1.48	0.00	0.00	1.91
07/09/97	0.04	7.70	-0.17	0.00	0.00	0.21
07/10/97	0.06	8.33	0.63	0.00	0.00	0.00
07/11/97	0.03	9.94	1.61	0.00	0.00	0.00
07/12/97	0.09	7.91	-2.02	0.00	0.00	2.11
07/13/97	0.00	9.52	1.61	0.00	0.00	0.00
07/14/97	0.03	9.92	0.40	0.00	0.00	0.00
07/15/97	0.04	7.43	-2.50	0.00	0.00	2.54
07/16/97	0.06	7.57	0.15	0.00	0.00	0.00
07/17/97	0.00	6.98	-0.59	0.00	0.00	0.59
07/18/97	0.00	7.85	0.87	0.00	0.00	0.00

07/19/97	0.00	7.38	-0.47	0.00	0.00	0.47
07/20/97	0.17	7.97	0.59	0.00	0.00	0.00
07/21/97	1.75	15.47	7.50	0.07	0.00	0.00
07/22/97	0.00	14.02	-1.46	0.00	0.00	1.46
07/23/97	0.00	14.02	0.01	0.00	0.00	0.00
07/24/97	0.13	13.53	-0.49	0.00	0.00	0.62
07/25/97	0.00	12.84	-0.69	0.00	0.00	0.69
07/26/97	0.03	11.84	-1.00	0.00	0.00	1.02
07/27/97	0.00	10.98	-0.86	0.00	0.00	0.86
07/28/97	0.10	10.66	-0.32	0.00	0.00	0.43
07/29/97	0.67	14.33	3.67	0.08	0.00	0.00
07/30/97	0.06	13.80	-0.53	0.00	0.00	0.60
07/31/97	0.05	13.51	-0.29	0.00	0.00	0.34
08/01/97	0.01	11.73	-1.78	0.00	0.00	1.79
08/02/97	0.00	10.22	-1.51	0.00	0.00	1.51
08/03/97	0.00	9.70	-0.52	0.00	0.00	0.52
08/04/97	0.00	9.36	-0.34	0.00	0.00	0.34
08/05/97	0.00	8.96	-0.41	0.00	0.00	0.41
08/06/97	0.00	8.97	0.01	0.00	0.00	0.00
08/07/97	0.03	8.22	-0.74	0.00	0.00	0.77
08/08/97	0.00	7.76	-0.47	0.00	0.00	0.47
08/09/97	0.03	9.90	2.14	0.00	0.00	0.00
08/10/97	0.03	9.93	0.03	0.00	0.00	0.00
08/11/97	0.00	10.15	0.22	0.00	0.00	0.00
08/12/97	0.00	10.28	0.13	0.00	0.00	0.00
08/13/97	0.00	9.94	-0.34	0.00	0.00	0.34
08/14/97	0.00	10.04	0.10	0.00	0.00	0.00
08/15/97	0.09	9.65	-0.39	0.00	0.00	0.48
08/16/97	0.37	9.46	-0.19	0.00	0.00	0.56
08/17/97	0.03	10.09	0.63	0.00	0.00	0.00
08/18/97	0.00	7.73	-2.36	0.00	0.00	2.36
08/19/97	0.05	9.84	2.11	0.00	0.00	0.00
08/20/97	0.01	7.53	-2.31	0.00	0.00	2.33
08/21/97	0.08	7.25	-0.28	0.00	0.00	0.35
08/22/97	0.00	7.32	0.07	0.00	0.00	0.00
08/23/97	0.00	7.33	0.02	0.00	0.00	0.00
08/24/97	0.00	6.99	-0.34	0.00	0.00	0.34
08/25/97	0.01	9.44	2.45	0.00	0.00	0.00
08/26/97	0.00	7.19	-2.25	0.00	0.00	2.25
08/27/97	0.14	9.17	1.98	0.00	0.00	0.00
08/28/97	0.01	6.93	-2.25	0.00	0.00	2.26
08/29/97	0.00	8.97	2.05	0.00	0.00	0.00
08/30/97	0.17	8.97	-0.01	0.00	0.00	0.17
08/31/97	0.00	7.09	-1.87	0.00	0.00	1.87
09/01/97	0.00	6.46	-0.63	0.00	0.00	0.63
09/02/97	0.00	8.81	2.35	0.00	0.00	0.00

09/03/97	0.00	7.02	-1.80	0.00	0.00	1.80
09/04/97	0.00	6.51	-0.50	0.00	0.00	0.50
09/05/97	0.00	6.89	0.37	0.00	0.00	0.00
09/06/97	0.00	6.76	-0.13	0.00	0.00	0.13
09/07/97	0.01	6.17	-0.59	0.00	0.00	0.60
09/08/97	0.00	6.56	0.39	0.00	0.00	0.00
09/09/97	0.00	6.40	-0.16	0.00	0.00	0.16
09/10/97	0.04	6.73	0.34	0.00	0.00	0.00
09/11/97	0.13	6.46	-0.27	0.00	0.00	0.40
09/12/97	0.01	6.64	0.17	0.00	0.00	0.00
09/13/97	0.04	7.29	0.65	0.00	0.00	0.00
09/14/97	0.00	7.26	-0.03	0.00	0.00	0.03
09/15/97	0.09	6.86	-0.40	0.00	0.00	0.49
09/16/97	0.03	6.26	-0.60	0.00	0.00	0.63
09/17/97	0.01	7.08	0.82	0.00	0.00	0.00
09/18/97	0.20	8.19	1.11	0.00	0.00	0.00
09/19/97	0.05	6.93	-1.26	0.00	0.00	1.31
09/20/97	0.09	7.81	0.88	0.00	0.00	0.00
09/21/97	0.00	6.65	-1.16	0.00	0.00	1.16
09/22/97	0.00	7.23	0.58	0.00	0.00	0.00
09/23/97	0.04	6.62	-0.61	0.00	0.00	0.65
09/24/97	0.01	8.97	2.35	0.00	0.00	0.00
09/25/97	0.04	7.72	-1.26	0.00	0.00	1.29
09/26/97	0.23	6.61	-1.11	0.00	0.00	1.33
09/27/97	0.05	6.90	0.29	0.00	0.00	0.00
09/28/97	0.15	6.68	-0.22	0.00	0.00	0.37
09/29/97	0.00	7.44	0.76	0.00	0.00	0.00
09/30/97	0.00	7.44	0.01	0.00	0.00	0.00
10/01/97	0.22	7.86	0.41	0.00	0.00	0.00
10/02/97	0.39	10.81	2.96	0.00	0.00	0.00
10/03/97	0.19	12.22	1.41	0.00	0.00	0.00
10/04/97	0.10	12.39	0.17	0.00	0.00	0.00
10/05/97	0.05	12.20	-0.19	0.00	0.00	0.24
10/06/97	0.00	11.85	-0.36	0.00	0.00	0.36
10/07/97	0.01	11.20	-0.65	0.00	0.00	0.66
10/08/97	0.14	10.74	-0.46	0.03	0.00	0.57
10/09/97	0.29	12.53	1.80	0.05	0.00	0.00
10/10/97	0.19	14.18	1.64	0.00	0.00	0.00
10/11/97	0.08	13.71	-0.46	0.00	0.00	0.54
10/12/97	0.05	13.93	0.22	0.03	0.00	0.00
10/13/97	0.01	13.64	-0.29	0.00	0.00	0.31
10/14/97	0.04	13.27	-0.37	0.00	0.00	0.41
10/15/97	0.05	12.65	-0.61	0.00	0.00	0.66
10/16/97	0.00	11.00	-1.65	0.00	0.00	1.65
10/17/97	0.08	10.47	-0.53	0.00	0.00	0.61
10/18/97	0.00	10.02	-0.45	0.00	0.05	0.39

10/19/97	0.00	9.57	-0.45	0.00	0.00	0.45
10/20/97	0.00	9.34	-0.23	0.00	0.00	0.23
10/21/97	0.03	9.18	-0.16	0.00	0.00	0.19
10/22/97	0.00	8.03	-1.15	0.00	0.00	1.15
10/23/97	0.00	7.88	-0.15	0.00	0.00	0.15
10/24/97	0.05	9.25	1.37	0.00	0.00	0.00
10/25/97	0.00	9.08	-0.17	0.00	0.00	0.17
10/26/97	0.00	9.44	0.36	0.00	0.00	0.00
10/27/97	0.00	8.91	-0.53	0.00	0.00	0.53
10/28/97	0.00	9.03	0.11	0.00	0.00	0.00
10/29/97	0.06	6.86	-2.17	0.00	0.00	2.23
10/30/97	0.10	6.73	-0.13	0.00	0.00	0.23
10/31/97	0.15	14.84	8.11	0.24	0.00	0.00
11/01/97	0.17	13.87	-0.97	0.00	0.00	1.13
11/02/97	0.10	13.60	-0.27	0.00	0.00	0.37
11/03/97	0.05	14.00	0.40	0.00	0.00	0.00
11/04/97	0.03	15.93	1.93	0.04	0.00	0.00
11/05/97	0.03	15.86	-0.07	0.00	0.00	0.09
11/06/97	0.01	15.75	-0.12	0.03	0.00	0.10
11/07/97	0.01	15.28	-0.47	0.00	0.00	0.48
11/08/97	0.01	14.91	-0.37	0.00	0.00	0.38
11/09/97	0.01	14.47	-0.44	0.00	0.00	0.45
11/10/97	0.01	13.92	-0.55	0.00	0.00	0.56
11/11/97	0.00	13.13	-0.79	0.00	0.00	0.79
11/12/97	0.00	13.11	-0.03	0.00	0.00	0.03
11/13/97	0.01	11.79	-1.32	0.00	0.00	1.33
11/14/97	0.01	10.73	-1.06	0.00	0.00	1.07
11/15/97	0.00	10.32	-0.41	0.00	0.00	0.41
11/16/97	0.00	9.78	-0.53	0.00	0.00	0.53
11/17/97	0.09	9.43	-0.35	0.11	0.04	0.29
11/18/97		11.03	1.61	0.00	0.00	0.00
11/19/97		10.92	-0.11	0.00	0.00	0.11
11/20/97		11.13	0.21	0.00	0.00	0.00
11/21/97	0.01	10.22	-0.91	0.00	0.00	0.92
11/22/97	0.03	10.32	0.10	0.00	0.00	0.00
11/23/97	0.18	10.08	-0.24	0.00	0.00	0.42
11/24/97	0.00	9.63	-0.45	0.00	0.00	0.45
11/25/97	0.10	9.28	-0.36	0.00	0.00	0.46
11/26/97	0.64	9.39	0.11	0.00	0.00	0.52
11/27/97	0.01	10.56	1.17	0.00	0.00	0.00
11/28/97	0.19	11.25	0.69	0.00	0.00	0.00
11/29/97	0.58	10.46	-0.78	0.00	0.00	1.37
11/30/97	0.14	13.38	2.91	0.04	0.00	0.00
12/01/97	0.00	13.25	-0.12	0.00	0.00	0.12
12/02/97	0.00	12.31	-0.95	0.00	0.00	0.95
12/03/97	0.00	11.06	-1.25	0.00	0.00	1.25

12/04/97	0.05	9.55	-1.51	0.00	0.00	1.56
12/05/97	0.05	9.47	-0.08	0.00	0.00	0.13
12/06/97	0.17	10.08	0.61	0.00	0.00	0.00
12/07/97	0.19	10.29	0.21	0.00	0.00	0.00
12/08/97	0.29	10.62	0.33	0.00	0.00	0.00
12/09/97	0.05	11.21	0.59	0.00	0.00	0.00
12/10/97	0.08	11.56	0.35	0.00	0.00	0.00
12/11/97	0.01	11.06	-0.50	0.00	0.00	0.51
12/12/97	0.00	11.08	0.02	0.00	0.00	0.00
12/13/97	0.05	10.46	-0.62	0.00	0.00	0.67
12/14/97	0.00	9.39	-1.06	0.00	0.00	1.06
12/15/97	0.06	9.21	-0.18	0.00	0.00	0.24
12/16/97	0.01	9.18	-0.03	0.00	0.00	0.05
12/17/97	0.55	9.23	0.05	0.07	0.00	0.42
12/18/97	0.03	11.80	2.58	0.00	0.00	0.00
12/19/97	0.24	12.78	0.97	0.00	0.00	0.00
12/20/97	0.00	13.37	0.59	0.00	0.00	0.00
12/21/97	0.03	12.61	-0.76	0.00	0.00	0.78
12/22/97	0.05	12.26	-0.35	0.00	0.00	0.40
12/23/97	0.11	12.46	0.21	0.00	0.00	0.00
12/24/97	0.17	12.62	0.16	0.00	0.00	0.01
12/25/97	0.01	12.43	-0.19	0.00	0.00	0.20
12/26/97	0.04	11.85	-0.59	0.00	0.00	0.63
12/27/97	0.11	11.60	-0.25	0.00	0.00	0.36
12/28/97	0.61	13.77	2.17	0.07	0.00	0.00
12/29/97	0.33	14.08	0.31	0.00	0.00	0.02
12/30/97						0.00
12/31/97						0.00
01/01/98	0.00	14.35	0.27	0.00	0.25	0.00
01/02/98	0.00	14.38	0.03	0.00	0.00	0.00
01/03/98	0.00	14.50	0.12	0.00	0.00	0.00
01/04/98	0.06	13.91	-0.58	0.00	0.69	0.00
01/05/98	0.28	14.23	0.32	0.14	0.00	0.00
01/06/98	0.03	15.12	0.88	0.00	0.13	0.00
01/07/98	0.01	14.79	-0.33	0.00	0.26	0.08
01/08/98	0.00	14.72	-0.07	0.00	0.00	0.07
01/09/98	0.01	14.05	-0.67	0.00	0.00	0.69
01/10/98	0.00	13.69	-0.36	0.00	0.00	0.35
01/11/98	0.00	13.29	-0.39	0.00	0.00	0.39
01/12/98	0.00	13.04	-0.25	0.00	0.00	0.25
01/13/98	0.01	12.52	-0.52	0.00	0.00	0.53
01/14/98	0.00	12.02	-0.51	0.00	0.00	0.51
01/15/98	0.00	11.84	-0.18	0.00	0.00	0.18
01/16/98	0.00	11.63	-0.21	0.00	0.00	0.21
01/17/98	0.14	11.02	-0.61	0.00	0.00	0.75
01/18/98	0.04	12.62	1.60	0.00	0.00	0.00

01/19/98	0.01	12.51	-0.11	0.00	0.31	0.00
01/20/98	0.01	11.47	-1.04	0.00	0.17	0.88
01/21/98	0.00	11.03	-0.45	0.00	0.00	0.45
01/22/98	0.01	10.86	-0.16	0.00	0.00	0.17
01/23/98	0.00	11.44	0.58	0.00	0.00	0.00
01/24/98	0.00	10.68	-0.76	0.00	0.00	0.76
01/25/98	0.04	10.06	-0.62	0.00	0.00	0.66
01/26/98	0.00	10.00	-0.06	0.00	0.00	0.06
01/27/98	0.10	9.82	-0.19	0.00	0.00	0.29
01/28/98	0.01	9.68	-0.14	0.00	0.00	0.15
01/29/98	0.00	10.19	0.51	0.00	0.00	0.00
01/30/98	0.00	9.50	-0.68	0.00	0.00	0.68
01/31/98	0.00	9.21	-0.29	0.00	0.00	0.29
02/01/98	0.22	9.46	0.25	0.00	0.00	0.00
02/02/98	0.01	9.83	0.37	0.00	0.00	0.00
02/03/98	0.00	8.96	-0.87	0.00	0.00	0.87
02/04/98	0.04	9.01	0.05	0.00	0.00	0.00
02/05/98	0.00	9.71	0.70	0.00	0.00	0.00
02/06/98	0.00	9.69	-0.02	0.00	0.00	0.02
02/07/98	0.00	8.65	-1.04	0.00	0.00	1.04
02/08/98	0.00	9.52	0.87	0.00	0.00	0.00
02/09/98	0.00	8.64	-0.88	0.00	0.00	0.88
02/10/98	0.00	8.85	0.20	0.00	0.00	0.00
02/11/98	0.00	8.48	-0.36	0.00	0.00	0.36
02/12/98	0.00	7.72	-0.77	0.00	0.00	0.77
02/13/98	0.05	7.38	-0.34	0.00	0.00	0.39
02/14/98	0.03	7.42	0.04	0.00	0.00	0.00
02/15/98	0.00	7.44	0.02	0.00	0.00	0.00
02/16/98	0.00	9.50	2.06	0.00	0.00	0.00
02/17/98	0.00			0.00	0.00	0.00
02/18/98	0.00	9.14	-0.35	0.00	0.00	0.35
02/19/98	0.00	10.06	10.06	0.00	0.00	0.00
02/20/98	0.00	9.10	-0.04	0.00	0.00	0.04
02/21/98	0.00	9.85	-0.21	0.00	0.00	0.21
02/22/98	0.04	10.31	1.21	0.00	0.00	0.00
02/23/98	0.00	9.61	-0.24	0.00	0.00	0.24
02/24/98	0.03	9.14	-1.18	0.00	0.00	1.20
02/25/98	0.00	9.23	-0.37	0.00	0.00	0.37
02/26/98	0.00	9.29	0.15	0.00	0.00	0.00
02/27/98	0.00	9.36	0.12	0.00	0.00	0.00
02/28/98	0.00			0.00	0.00	0.00
03/01/98	0.13	8.87	-0.49	0.00	0.00	0.61
03/02/98	0.03	9.51	9.51	0.00	0.00	0.00
03/03/98	0.01	9.26	0.39	0.00	0.00	0.00
03/04/98	0.00	6.34	-3.17	0.00	0.00	3.16

03/05/98	0.00	8.75	-0.51	0.00	0.00	0.51
03/06/98	0.00	6.78	0.44	0.00	0.00	0.00
03/07/98	0.00	8.73	-0.02	0.00	0.00	0.02
03/08/98	0.05	8.13	1.35	0.00	0.00	0.00
03/09/98	0.00	8.62	-0.11	0.00	0.00	0.11
03/10/98	0.00	6.41	-1.72	0.00	0.00	1.72
03/11/98	0.00	9.22	0.60	0.00	0.00	0.00
03/12/98	0.00	9.38	2.98	0.00	0.00	0.00
03/13/98	0.00	8.90	-0.32	0.00	0.00	0.32
03/14/98	0.00	9.09	-0.29	0.00	0.00	0.29
03/15/98	0.00	9.21	0.32	0.00	0.00	0.00
03/16/98	0.20	9.43	0.33	0.00	0.00	0.00
03/17/98	0.00	9.52	0.31	0.00	0.00	0.00
03/18/98	0.00	8.53	-0.89	0.00	0.00	0.89
03/19/98	0.00	9.39	-0.13	0.00	0.00	0.13
03/20/98	0.00	10.42	1.89	0.00	0.00	0.00
03/21/98	0.04	9.36	-0.03	0.00	0.00	0.07
03/22/98	0.08	9.29	-1.13	0.00	0.00	1.21
03/23/98	0.00	8.00	-1.36	0.00	0.00	1.36
03/24/98	0.06	8.11	-1.18	0.00	0.00	1.24
03/25/98	0.04	7.77	-0.23	0.00	0.00	0.27
03/26/98	0.14	8.22	0.10	0.00	0.00	0.04
03/27/98	0.00	5.36	-2.41	0.00	0.00	2.41
03/28/98	0.00	5.00	-3.22	0.00	0.00	3.22
03/29/98	0.09	5.90	0.54	0.00	0.01	0.00
03/30/98	0.00	5.55	0.56	0.00	0.03	0.00

APPENDIX S (Cont.)

WEEKLY WATER BALANCE ON 40% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
07/24/97	0.38	8.19	-1.12	0.00	0.00	1.50
07/31/97	0.18	7.58	-0.60	0.00	0.00	0.00
08/08/97	0.11	6.52	-1.07	0.00	0.00	1.18
08/16/97	1.03	6.76	0.24	0.00	0.00	0.78
08/24/98	0.00		-6.76	0.00	0.00	6.76
08/31/98	2.22	6.48	6.48	0.10	0.00	0.00
09/08/98	2.11	12.00	5.52	0.07	0.00	0.00
09/16/98	0.39	9.31	-2.69	0.00	0.00	3.08
09/23/98	0.32	7.15	-2.16	0.00	0.00	2.48
09/30/98	0.24	6.67	-0.48	0.00	0.00	0.72
10/08/98	0.06	6.09	-0.58	0.00	0.00	0.64
10/16/98	0.37	6.31	0.21	0.00	0.00	0.15
10/24/98	0.56	6.18	-0.13	0.00	0.00	0.68
10/31/98	0.03	5.77	-0.41	0.00	0.00	0.00
11/08/98	15.68	9.56	3.80	4.76	0.44	6.68
11/16/98	21.49	21.83	12.27	5.46	0.50	0.00
11/23/98	1.24	28.00	6.17	0.26	0.46	0.00
11/30/98	0.06	20.64	-7.37	0.00	0.04	7.39
12/08/98	0.90	22.49	1.85	0.09	0.15	0.00
12/16/98	1.32	21.94	-0.55	0.05	0.02	1.80
12/24/98	1.09	17.43	-4.50	0.08	0.00	5.51
12/31/98	2.32	20.00	2.57	0.25	0.00	0.00
01/08/98	4.23	21.63	1.63	2.54	0.06	0.00
01/16/98	0.58	21.18	-0.45	0.00	0.03	1.00
01/24/98	6.65	21.44	0.26	2.81	0.13	3.45
01/31/98	1.14	21.14	-0.30	0.05	0.00	1.40
02/07/98	0.05	17.18	-3.96	0.00	0.00	4.01
02/14/98	0.03	17.98	0.81	0.00	0.00	0.00
02/21/98	0.24	12.49	-5.49	0.00	0.00	5.73
02/28/98	0.98	13.41	0.91	0.00	0.00	0.00
03/08/98	0.86	13.64	0.23	0.03	0.00	0.60
03/16/98	0.60	14.80	1.16	0.25	0.00	0.00
03/24/98	0.15	20.48	5.68	1.21	0.07	0.00
03/31/98	3.29	17.26	-3.23	0.11	0.29	6.12
04/08/98	4.85	21.88	4.62	0.90	0.23	0.00
04/16/98	0.10	16.54	-5.34	0.00	0.00	5.44
04/23/98	0.00	5.40	-11.14	0.00	0.00	11.14
04/30/98	0.06	12.99	7.59	0.00	0.00	0.00
05/08/98	3.02	14.99	2.01	1.26	0.03	0.00
05/16/98	1.14	19.87	4.88	0.03	0.00	0.00
05/24/98	0.29	17.28	-2.59	0.00	0.00	2.89

05/31/98	0.00	13.58	-3.69	0.00	0.00	3.69
06/08/98	0.53	12.23	-1.35	0.00	0.00	1.89
06/16/98	0.61	11.09	-1.14	0.00	0.00	1.75
06/23/98	0.57	9.81	-1.28	0.00	0.00	1.85
06/30/98	0.57	9.33	-0.48	0.00	0.00	1.05
07/08/98	0.80	8.41	-0.92	0.00	0.00	1.72
07/16/98	0.34	8.54	0.13	0.00	0.00	0.21
07/24/98	2.04	10.90	2.36	0.00	0.00	0.00
07/31/98	0.91	12.57	1.66	0.00	0.00	0.00
08/08/98	0.04	9.37	-3.20	0.00	0.00	3.24
08/16/98	0.51	9.92	0.55	0.00	0.00	0.00
08/24/98	0.17	8.01	-1.91	0.00	0.00	2.07
08/31/98	0.33	8.25	0.24	0.00	0.00	0.09
09/08/98	0.01	6.90	-1.35	0.00	0.00	1.37
09/16/98	0.33	6.74	-0.16	0.00	0.00	0.49
09/23/98	0.39	7.21	0.48	0.00	0.00	0.00
09/30/98	0.48	7.40	0.18	0.00	0.00	0.30
10/08/98	1.10	11.16	3.76	0.00	0.00	0.00
10/16/98	0.71	13.11	1.95	0.00	0.00	0.00
10/24/98	0.15	9.22	-3.90	0.00	0.00	4.05
10/31/98	0.32	9.27	0.05	0.00	0.00	0.26
11/08/98	0.41	14.90	5.63	0.00	0.00	0.00
11/16/98	0.05	12.16	-2.74	0.00	0.00	2.79
11/23/98	0.30	12.19	0.03	0.00	0.00	0.00
11/30/98	1.66	10.10	-2.09	0.00	0.00	3.76
12/08/98	0.75	10.83	0.73	0.07	0.00	0.00
12/16/98	0.27	10.39	-0.44	0.00	0.00	0.70
12/24/98	1.17	12.07	1.68	0.07	0.00	0.00
12/31/98	1.10	12.72	0.65	0.07	0.00	0.38
01/08/98	0.38	14.50	1.78	0.15	1.33	0.00
01/15/98	0.03	12.92	-1.58	0.00	0.00	1.60
01/23/98	0.22	11.57	-1.35	0.00	0.48	1.09
01/31/98	0.15	9.89	-1.68	0.00	0.00	1.83
02/07/98	0.27	9.33	-0.56	0.00	0.00	0.83
02/14/98	0.08	8.29	-1.04	0.00	0.00	1.12
02/21/98	0.00	9.18	0.90	0.00	0.00	0.00
02/28/98	0.06	8.13	-1.05	0.00	0.00	1.11
03/08/98	0.22	8.30	0.16	0.00	0.00	0.05
03/16/98	0.20	8.78	0.49	0.00	0.00	0.00
03/23/98	0.11	9.21	0.43	0.00	0.00	0.00
03/30/98	0.33	6.56	-2.66	0.00	0.03	2.96

APPENDIX S (Cont.)

MONTHLY WATER BALANCE ON 40% IC PLOTS (Units are in cm)						
	Precipitation (P)	Mean SM	Delta SM (dS/dt)	Runoff (R)	Percolation (L)	ET
07/31/96	0.56	7.89	-1.00	0.06	0.01	1.48
08/31/96	3.37	6.59	-1.30	0.10	0.00	4.57
09/30/96	3.06	8.78	2.20	0.07	0.01	0.79
10/31/96	1.02	6.09	-2.70	0.00	0.00	3.71
11/30/96	38.48	20.01	13.92	11.17	1.44	11.95
12/31/96	5.64	20.46	0.46	0.42	0.17	4.59
01/31/97	12.61	21.35	0.88	5.40	0.22	6.10
02/28/97	1.30	15.27	-6.08	0.00	0.00	7.38
03/31/97	4.90	16.55	1.28	1.61	0.10	1.92
04/30/97	5.02	14.20	-2.34	0.90	0.10	6.36
05/31/97	4.46	16.43	2.23	1.29	0.03	0.90
06/30/97	2.29	10.62	-5.82	0.00	0.00	8.10
07/31/97	4.10	10.11	-0.51	0.15	0.00	4.46
08/31/97	1.04	8.89	-1.22	0.00	0.00	2.26
09/30/97	1.22	7.06	-1.82	0.00	0.00	3.04
10/31/97	2.29	10.69	3.63	0.35	0.03	0.00
11/30/97	2.43	12.34	1.65	0.22	0.05	0.52
12/31/97	3.29	11.50	-0.83	0.14	0.00	3.98
01/31/98	0.77	12.22	0.72	0.15	0.01	0.00
02/28/98	0.41	8.73	-3.49	0.00	0.00	3.89
03/31/98	0.86	8.21	-0.52	0.00	0.01	1.38