THESIS

VEGETATION PATTERNS ALONG THE MIDDLE FORK OF THE FLATHEAD RIVER, GLACIER NATIONAL PARK, MONTANA

Submitted by

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY MARK WONDZELL ENTITLED VEGETATION PATTERNS ALONG THE MIDDLE FORK OF THE FLATHEAD RIVER, GLACIER NATIONAL PARK, MONTANA BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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ABSTRACT OF THESIS

VEGETATION PATTERNS ALONG THE MIDDLE FORK FLATHEAD RIVER, GLACIER NATIONAL PARK, MONTANA.

Distribution of riparian vegetation on riverine floodplains is dictated, in part, by species' response to flood disturbance. Plant position can be related to frequency, intensity and duration of flooding, with species most tolerant of flooding occurring in lower discharge classes and those less tolerant occurring in higher discharge classes.

Hydrologic conditions necessary to support distinct vegetation cover types and key indicator species along the Middle Fork of the Flathead River were identified and quantified. The natural flow regime of the Middle Fork was described in terms of the magnitude, frequency, and duration of discharge. Vegetation patterns were determined from species presence and relative abundance observed in transects located perpendicularly to the river and extending across the valley floor. A hydraulic model was used to compute the minimum discharge required to inundate each point along the transects. TWINSPAN (Hill 1979) analysis was used to identify four distinct cover types and several key indicator species. Direct gradient analysis was used to array cover types and key indicator species along a hydrologic gradient of inundation duration.

Plots within the unvegetated or barren cover type were characterized by a minimum inundating discharge of 250 cubic feet per second (cfs) and a fraction of time inundated of 10 percent or greater. The willow cover type was defined by flows between 1000 and 15000 cfs (which correspond to recurrence intervals of < 1 - 2 years) and a fraction of time inundated of 0.45 to 25 percent. The cottonwood cover type was distinguished by flows ranging from 10 to 25 thousand cfs, a recurrence interval of 1 to 10 years, and a fraction of time inundated of 0.25 to 2 percent. Plots

within the spruce cover type were characterized by flows greater than 25000 cfs, a recurrence interval of 10 years or more, and a fraction of time inundated of less than 0.35 percent. Key indicator species within a cover type (described in terms of density and percent absolute cover) were characterized by distinct hydrologic conditions representative of that particular cover type.

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INTRODUCTION

Glacier National Park, established May 11, 1910, is administered by the National Park Service. In 1916, Congress directed the Park Service to manage national parks, monuments, and reservations "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service Organic Act of 1916, 16 USC 1, 39 Stat. 535). Charged with this mission it became imperative that park managers evaluate resource impacts resulting from land management actions both in and near parks. Water and water-related resources are primary park resources which can be affected by land management actions.

Williams et al. (1988) introduced the concept of Departure Analysis, to assess impacts of land management decisions on water-related resources. The National Park Service is presently using Departure Analysis to quantify water and water-related resources in support of Federal reserved water right claims in several parks throughout the western United States.

Departure Analysis describes responses of water-related resource attributes to land use management actions which affect existing hydrologic regimes (Williams et al. 1988). By establishing baseline conditions for flow dependent resource attributes under existing hydrologic regimes, Departure Analysis can be applied to assess the response (or departure from existing conditions) of water-related resource attributes to hypothetical changes in flow regime.

The National Park Service is applying Departure Analysis in Glacier National Park to examine the effect hypothetical flow alterations may have on groundwater fauna, native fisheries and riparian vegetation. This study, which was conducted within the framework of Departure Analysis, will aid the Park Service in describing potential changes in riparian vegetation patterns due to hypothetical changes in the natural flow regime of the Middle Fork of the Flathead River within Glacier National Park, Montana.

Goal

Many water-related resource attributes are flow dependent and sensitive to low and/or high flows. Riparian vegetation, for example, depends not only on some minimum flow, but also, and perhaps even more importantly, on the existence of regular high flows. Van Haveren et al. (1987) suggest that the lack of high flows allows riparian vegetation to encroach on otherwise barren gravel bars thus dramatically changing the character of the river bank. Conversely, geomorphic processes associated with high flows serve to create landscape features (including vegetation nursery sites, upper floodplains, and terraces) which contribute to vegetation dynamics and riparian vegetation succession (Jackson, personal communication 1990). The goal of this study was to identify riparian vegetation distribution patterns that occur as a result of the natural streamflow regime of the Middle Fork of the Flathead River, Montana.

Objective

The objective of this study was to determine how natural streamflows affect the composition, areal extent and occurrence of riparian vegetation along the Middle Fork of the Flathead River, and to quantify the hydrologic conditions required to support this natural assemblage of vegetation.

This study coincided with National Park Service' research efforts during the 1990 summer season. It focused on selected segments of the

Middle Fork of the Flathead River that were identified as critical reaches for maintaining selected water-related resource values. The National Park Service will use the results of this study to establish baseline riparian conditions along the Middle Fork of the Flathead River, and to evaluate the impacts of altered flow regimes on the naturally occurring riparian community.

LITERATURE REVIEW

Riparian Vegetation

Riparian vegetation is that vegetation (i.e., those plant species and/or communities) whose survival, reproduction, or vigor is related, adapted or dependent upon streamflow, or some aspect of streamflow. Riparian vegetation occurs along drainageways and watercourses and their floodplains, and is structurally and floristically distinct from upland vegetation (Lowe 1964, as cited in Campbell and Green 1968, Johnson and Lowe 1985). Riparian areas are usually characterized by high water tables and by vegetation requiring water at or near the surface. Campbell and Green (1968) define riparian species as those whose life cycle is obligate to the watertable of the drainageway. The USDI-BLM (1985) defines a riparian ecosystem as the transitional area between the terrestrial and aquatic ecosystem, having distinct soil characteristics, and vegetation communities that require free and unbound water. Hansen (1989) refers to a riparian association as a plant community type which represents the latest successional stage attainable on a specifically hydrologically influenced surface, and which reflects an integration of environmental factors. Swanson et al. (1982a) and Hansen et al. (1988) define the riparian zone as the zone of direct interaction between terrestrial and aquatic environments. Swanson et al. (1982b) describe the riparian zone as a distinctive landscape element subject to disturbances characteristic of both the fluvial and terrestrial systems, with some distinct species not found in either one. Hansen et al. (1988) define riparian areas as those "green areas" associated with lakes, reservoirs, springs, and ephemeral, intermittent, or perennial streams.

Role of Riparian Ecosystems

Regardless of how it is defined, riparian ecosystems play a vital role in the ecology of the landscape. Drainageways and associated floodplains support impressive populations of plant and animal species as well as productive agricultural systems. Riparian vegetation provides a diverse and productive habitat for a large array of vertebrate species by providing a variety of food, cover and nesting sites. Streamside vegetation provides and regulates the energy base of the aquatic ecosystem by supplying the streams with plant and animal detritus (Swanson et al. 1982a). This organic material becomes the food base for both the terrestrial and aquatic ecosystems (McNatt et al. 1980). Riparian vegetation is important for maintaining water quality, for flood water storage, bank stabilization, erosion control and groundwater recharge (Brinson et al. 1981).

Functions and Uses of Riparian Ecosystems

Riparian areas serve a variety of important uses and functions. These areas provide important recreational, aesthetic, and natural resource opportunities and experiences. The presence of flowing water, high plant productivity, fertile and well developed soils, and nutrient rich conditions make them especially attractive for settlement, agriculture, commerce, and land and water based transportation. They are often a source of timber, water, wildlife, and various other natural resources.

Today, however, riparian ecosystems are so altered and influenced by humans that only a fraction of the original pre-settlement floodplain area is occupied by natural riparian vegetation (Brinson et al. 1981). Maddock (1976) estimated that approximately 9.5 percent of all cultivable land and 16.5 percent of all urban land in the United States occurred within floodplains. Water resource and other cultural developments within riparian corridors have resulted in approximately 60 percent of the major stream segments in the United States failing to qualify for National Wild and Scenic River status. As of 1981, approximately 70 percent of the original floodplain forests had been lost to urban, agricultural or other land uses. As a result, natural riparian communities comprised less than 2 percent of the land area in the United States in 1981 (Brinson et al. 1981). Because riparian communities constitute such a small fraction of the current land area, and because they play such a vital role in the ecology of the landscape, understanding these communities, how they change over time, and the relationships between riparian vegetation and the physical, chemical, and biological environments, is essential to proper maintenance, management, and enhancement of these ecosystems.

Factors Influencing Riparian Ecosystems

Many environmental factors and natural processes govern and determine the distribution, areal extent, composition, structure, and form of riparian vegetation. Water availability, channel processes and fluvial geomorphology, channel migration and form, sediment dynamics, soil characteristics, physical and chemical water quality, nutrient availability, climate, weather, plant interactions, and frequency of disturbance influence, and often dictate, riparian community characteristics.

Riparian plant distributions are controlled, in part, by moisture availability. The timing, duration, and frequency of inundation, depth to groundwater, and proximity to flowing water influence the distribution and composition of riparian vegetation. Lee (1983) found that presence or absence of inundation influenced trends in floodplain plant community succession, and floodplain soil development and fertility. Often the elevation at which germination takes place coupled with the magnitude and frequency of peak flows determines the extent and distribution of woody vegetation establishment (O'Brien and Currier 1987). Some species (Hosner 1958), or even some life stages of the same species (Bell 1974a, Kozlowski 1984), may have a greater ability to tolerate destructive flooding, high velocities, and the anoxic soil conditions associated with prolonged inundation. Knopf and Scott (1990) state that the pulsed hydroperiod is the principal driving ecological force within floodplains responsible for changes in streamside plant communities. Teskey and Hinckley (1977) feel that the major effect of flooding is to create an anaerobic environment which surrounds the root system and interferes with normal root functions, thereby creating a variety of stresses on the plant. Fischer et al. (1983) identified inundation and scouring as the two principal flooding components influencing streamside vegetation along the Green and Yampa Rivers in Colorado.

Flooding and flow waters are also responsible for depositing, eroding, and transporting sediments and nutrients. By removing vegetation and exposing new seedbeds for germination, establishment, and growth, floods and flow waters play a vital role in maintaining riparian ecosystems (Brinson et al. 1981). Soil saturation, bank storage, and groundwater recharge associated with springtime flooding is often necessary to sustain plant communities through drier periods late in the growing season (Reily and Johnson 1982), and may even result in increased growth rates (Teskey and Hinckley 1977). Some researchers have identified water and fluvial geomorphology as the two principal ecological factors controlling the structure and composition of riparian vegetation

(Biosystems 1988, Hack and Goodlet 1960, Leopold et al. 1964). Hupp (1988) distinguished soil age (i.e., age of fluvial sediments) and flood frequency as the two primary factors influencing riparian vegetation. He further stated that fluvial landforms themselves do not determine vegetation patterns, but rather it is the processes of inundation, erosion, and deposition that shape landforms which, in turn, support various assemblages of vegetation adapted to these processes.

There is substantial evidence indicating that riparian plant communities are distributed in patterns related to geomorphic processes on floodplains. Harris (1987) found flood controlled erosional and depositional surfaces along Cottonwood Creek, California to support distinct plant communities dominated by different species in relation to flood-induced disturbance. Irvine and West (1979) demonstrated similar relationships along the lower Escalante River, Utah. On the North and South Platte Rivers, Knopf and Scott (1990) found that historic hydrologic conditions responsible for maintaining a braided river form controlled the pattern of establishment and growth of woody riparian species. The processes of erosive downcutting, alluvial deposition and channel migration and abandonment often create a diversity of plant and animal communities. In the western United States, catastrophic episodes of flooding are usually more important than average streamflow in molding and shaping the landscape through erosion, sedimentation, and channel migration (Brinson et al. 1981).

Factors other than streamflow often influence riparian community characteristics. Harris et al. (1985) found riparian zone width to be controlled by floodplain width which in turn was controlled by physiographic conditions such as geology, and erosional and depositional status. Transport and storage of alluvium during floods also plays a part in determining riparian vegetation patterns. These processes affect soil development, soil fertility, soil porosity, and substrate type. They also concentrate nutrients and organic matter which then become available for plant growth. Particle size and substrate permeability greatly influence moisture availability. Larger, more permeable substrata will result in greater lateral percolation and higher water movement rates which allows subsurface waters to extend farther from the main channel. However, lateral percolation requires a saturated groundwater table, and the saturated width (at any given depth) is a function of both substrate size and the width of the alluvial aquifer.

Climate and weather may also have a predominating influence on riparian community characteristics. Together they tend to dictate moisture availability (i.e., snowpack depth; timing of snowmelt; form, intensity, timing of precipitation), photoperiod, timing of seed dispersal, and length of growing season, all of which have a profound effect on floodplain community composition. Plant interactions and competition for sunlight, space, and nutrients, for example, may preferentially favor one species over another. Disturbance frequency and intensity may also dictate vegetation patterns. Knopf and Scott (1990) described the original, pre-settlement floodplains of the North and South Platte Rivers as disturbance-mediated landscapes requiring periodic major flooding to maintain primary successional vegetative associations.

Together, these factors often combine and integrate to form a complex set of environmental gradients that influence and dictate riparian community dynamics. This complex gradient of environmental factors is more or less oriented perpendicularly to the main channel (Kozlowski 1984). Plant communities tend to array along gradients of environmental variables wherein each species is distributed according to its own response to a given gradient. This is known as the continuum concept of vegetation (McIntosh 1967). In Figure 1, for example, those plant species found immediately adjacent to the active channel are well adapted to the high velocities, shear stresses, coarse textured substrate, shallow water table, and physical battering associated with relatively frequent periods of intense flooding and prolonged inundation. Further from the active channel the impact of flooding is less severe and less frequent. Consequently, the plant species found here are well suited to a suite of environmental conditions characterized by more fertile and better developed soils, greater depths to groundwater, increased nutrient availability, decreased velocities, lower shear stresses, and finer textured substrate. Stromberg and Patten (1989) stated that woody riparian species represent an integration of all environmental factors, with the availability of supplemental water being the most critical. Bell (1974a) stated that communities intergrade continuously along environmental gradients rather than forming separate, distinct vegetational units which he attributed to discontinuities in abiotic factors.

Several studies have suggested relationships between vegetation patterns and environmental gradients. Direct gradient analysis is a method often used to portray the distribution of vegetation along recognized, easily measured, environmental gradients (Whittaker 1967). Lee (1983) showed that distributions of floodplain and wetland plant communities were correlated with gradients in soil development and fertility, and site moisture regimes which accounted for the effects of inundation. As reported by Akashi (1988), Miller (1979) and Julian (1971) classified riparian vegetation along the Tongue River and Green River, respectively, and examined the relationships between various riparian

CROSS-SECTIONAL PROFILE

TYPICAL RIPARIAN TRANSECT

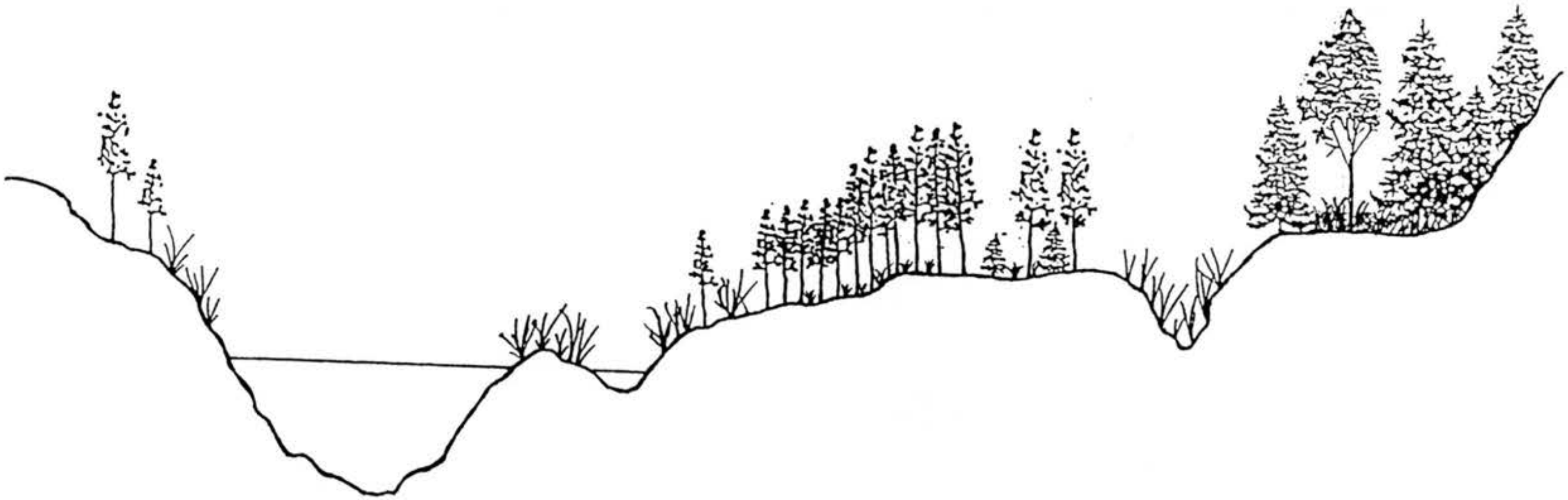

Figure 1. Cross-sectional profile of a typical riparian transect.

communities and soil characteristics. Hosner and Boyce (1962) found floodplain species to sort along gradients of low oxygen and high carbon dioxide levels in the rooting zone during flood conditions according to their respective tolerance levels. Olsvig-Whittaker et al. (1983) found spatial patterns of vegetation in a Negev Desert watershed to be related to differences in soil moisture availability. Wondzell et al. (1990) found spatial patterns of vegetation on an ephemeral lake bed in the northern Chihuahuan desert to be closely correlated with elevation, and strongly influenced by differences in physical and chemical soil properties, and frequency and duration of flooding. Everitt (1968) found germination and growth of cottonwood trees along the Little Missouri River of western North Dakota to be related to stream discharge, channel movement, and floodplain development. Osterkamp and Hupp (1984) found bottomland geomorphic surfaces to be hydraulically controlled, with each surface supporting characteristic, and often unique, plant species. They concluded that plant distributions are largely controlled by flow frequency and intensity.

Relationship between Riparian Ecosystems and Hydrology

To this end, several studies have suggested plant position on riverine floodplains to be related to gradients of flood frequency, intensity and/or duration. As elevation above the main channel increases, frequency of flooding decreases, and the number of species capable of surviving in the habitat increases (Bell 1974b). This results in major shifts in species dominance, composition, growth-form, density, coverage, and species richness (Fischer et al. 1983). Bell (1974a) found woody vegetation along the Sangamon River in Illinois to be strongly influenced by the distribution and frequency of flood inundation levels. He related the distribution of tree species to elevation above the river and the elevational distributions of hydrologic events. He concluded that the natural arrangement of species on a vertical gradient was a direct ordination along a gradient of flood severity, with species replacing each other along the gradient according to their relative flood tolerance. He also found understory vegetation to exhibit a similar gradient response to elevational distribution of flood frequencies (Bell 1974b).

Lindsey et al. (1961) and Sigafoos (1961) found spatial distributions of floodplain trees along gradients of flood frequency to indicate species tolerance to flooding, and most likely, tolerance during the seedling stage of development. Harris et al. (1985) suggested that distribution of riparian vegetation was dictated by species' response to ecological conditions within the floodplain. Typically, those species most tolerant of flooding are found in relatively high abundance in lower discharge classes, and species least tolerant of flooding are found in higher discharge classes.

Johnson et al. (1976) found overstory structure and composition along the Missouri River to be strongly related to stand age and horizontal and vertical position on the floodplain. Sigafoos (1961) suggested that the species and form of trees growing on floodplains along the Potomac River were largely a function of the magnitude and frequency of floods. Bedinger (1971) found flood frequency and duration of inundation to be the dominant characteristics of forest habitats along the White River valley in Arkansas. Bell (1980) suggested that distribution of streamside forest species was primarily controlled by species' tolerance to flood and moisture conditions. Hupp and Osterkamp (1985) and Hupp (1983) suggested that flood disturbance was an integral factor in the formation and maintenance of vegetation patterns.

Several researchers have developed methods for determining flow needs and evaluating the impacts of altered flows on various water related resources, especially fisheries. These needs and impacts often differ significantly from the needs of, and impacts to, riparian vegetation. Instream flows for riparian resources generally require greater flows and/or flooding events, and must consider seedling establishment, timing of seed dispersal, and tree maintenance (Stromberg and Patten 1989). To date, most studies of riparian vegetation and streamflow relationships have focused on vegetation responses to altered streamflows and/or the effects of inundation upstream or downstream of impoundments (Pelzman 1973, Turner 1974, Turner and Karpiscak 1980, Harris et al. 1987). Few studies have addressed riparian community dynamics on unregulated systems, especially one as large and relatively pristine as the Middle Fork of the Flathead River, in Glacier National Park, Montana.

Most riparian research to date, has focused on stream systems of the eastern (Sigafoos 1961, Yanosky 1982, Bell 1974a, 1974b, and 1980, Hupp 1983, Wistendahl 1958, Hupp and Osterkamp 1985, Buell and Wistendahl 1955), southeastern (Bedinger 1971 and 1979, Huffman 1980, Robertson et al. 1978), and southwestern United States (Irvine and West 1979, Campbell and Green 1968, Turner 1974), with notable exceptions along the Missouri (Reilly and Johnson 1982, Johnson et al. 1976, Everitt 1968), North and South Platte Rivers (Knopf and Scott 1990, Nadler and Schumm 1981, Johnson 1990, Crouch 1979, Currier 1982, O'Brien and Currier 1987, Eschner et al. 1983), and isolated streams in the Sierra Nevadas of California (Harris 1985 and 1987, Harris et al. 1985, Kondolf et al. 1986, McBride and Strahan 1984a and 1984b, Stromberg and Patten 1990).

Riparian research in the Pacific Northwest, Northern Rocky Mountains, and northwestern Montana in particular, has been limited to low-order, forested, mountain watersheds. There are, however, a few notable exceptions. Bradley and Smith (1986) studied cottonwood reproduction in relation to flood frequency and magnitude along the Milk River in Montana and Alberta, Canada. Bliss and Cantlon (1957) studied vegetation succession on river alluvium along the Colville River on the Arctic Slope of Alaska. Viereck (1970) studied forest succession and soil development along the Chen River in the interior of Alaska. Lee (1983) showed that the distributions of floodplain and wetland plant communities along the North Fork Flathead River, Montana and Suiattle River, Washington were correlated with gradients in soil development and fertility, and site moisture regimes which accounted for the effects of inundation. Brink (1954) studied the effects of extreme floods during the growing season on vegetation along the lower Fraser River Valley in British Columbia, Canada. Teversham and Slaymaker (1976) related vegetation composition on stable versus unstable reaches of the Lillooet River Valley in British Columbia to frequency of flooding. Nanson and Beach (1977) investigated interrelationships between forest succession and fluvial geomorphic processes on the Beatton River in northeast British Columbia, Canada. Fyles and Bell (1986) studied riparian plant communities inhabiting gravel bars along several streams in the Rocky Mountains of southeastern British Columbia. Dalby (1983) evaluated the impacts of landuses on the hydrology and fluvial geomorphology of the North Fork of the Flathead River, Montana. Key (1979) studied mammalian utilization of floodplain habitats along the North Fork of the Flathead River in Glacier National Park, Montana.

The vast majority of riparian vegetation research in the northwest United States, however, has focused on identifying and classifying riparian vegetation (Allen 1980, Lee 1979, Hansen 1989, Hansen et al.

1988, Edwards 1957, Habeck 1970, Koterba and Habeck 1971, Robinson 1956), and very little, if any, work has been done relating riparian vegetation distributions to gradients of flood frequency and inundation. And even fewer studies have addressed this question with regards to unregulated systems as large and relatively pristine as the Middle Fork of the Flathead River in Glacier National Park, Montana.

THE STUDY AREA

Location

Glacier National Park is located in northwestern Montana and shares a 39 mile international border with Canada (Figure 2). This 1,013,595 acre park is part of the headwaters of the Clark Fork River, Upper Missouri River and Waterton River basins. It is bordered on the west by the North Fork of the Flathead River, on the south by the Middle Fork of the Flathead River and its tributaries Bear Creek and Summit Creek, and on the east by the Blackfeet Indian Reservation (Figures 2 and 3). The headwaters of Glacier National Park ultimately flow into the Arctic, Atlantic or Pacific Oceans.

The park is located at the center of one of the largest remaining intact wild ecosystems of the Rocky Mountain Region (USDI-NPS 1988). Canada's Waterton Lakes National Park to the north and the Great Bear, Bob Marshall and Scapegoat Wildernesses to the south form a protective buffer on two sides of the park. To the west is the Flathead National Forest, an area that is still largely undeveloped, as is the Blackfeet Indian Reservation to the east (Figures 2 and 3).

Climate and Vegetation

Glacier National Park lies at the southern edge of the Northern Rocky Mountains and is noted for its sculptured glacial landscapes, massive mountains, spectacular valleys, pristine wilderness, and diverse biotic communities. High mountains, 8000 to 10000 feet (ft) above mean sea level, bisect the park and create a diversity of climates. The mountains receive an average of 39 or more inches of annual precipitation, while the

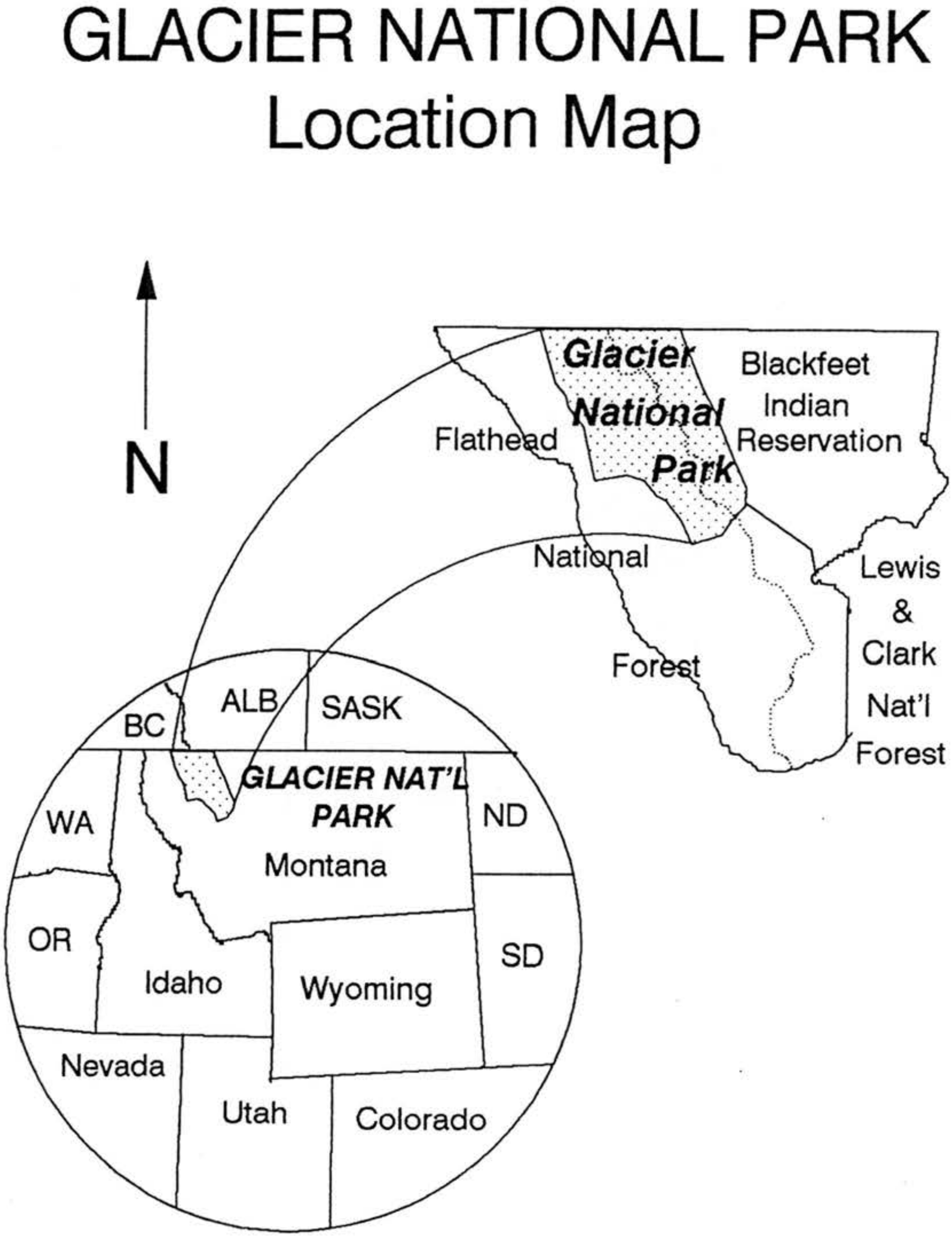

Figure 2. Location map.

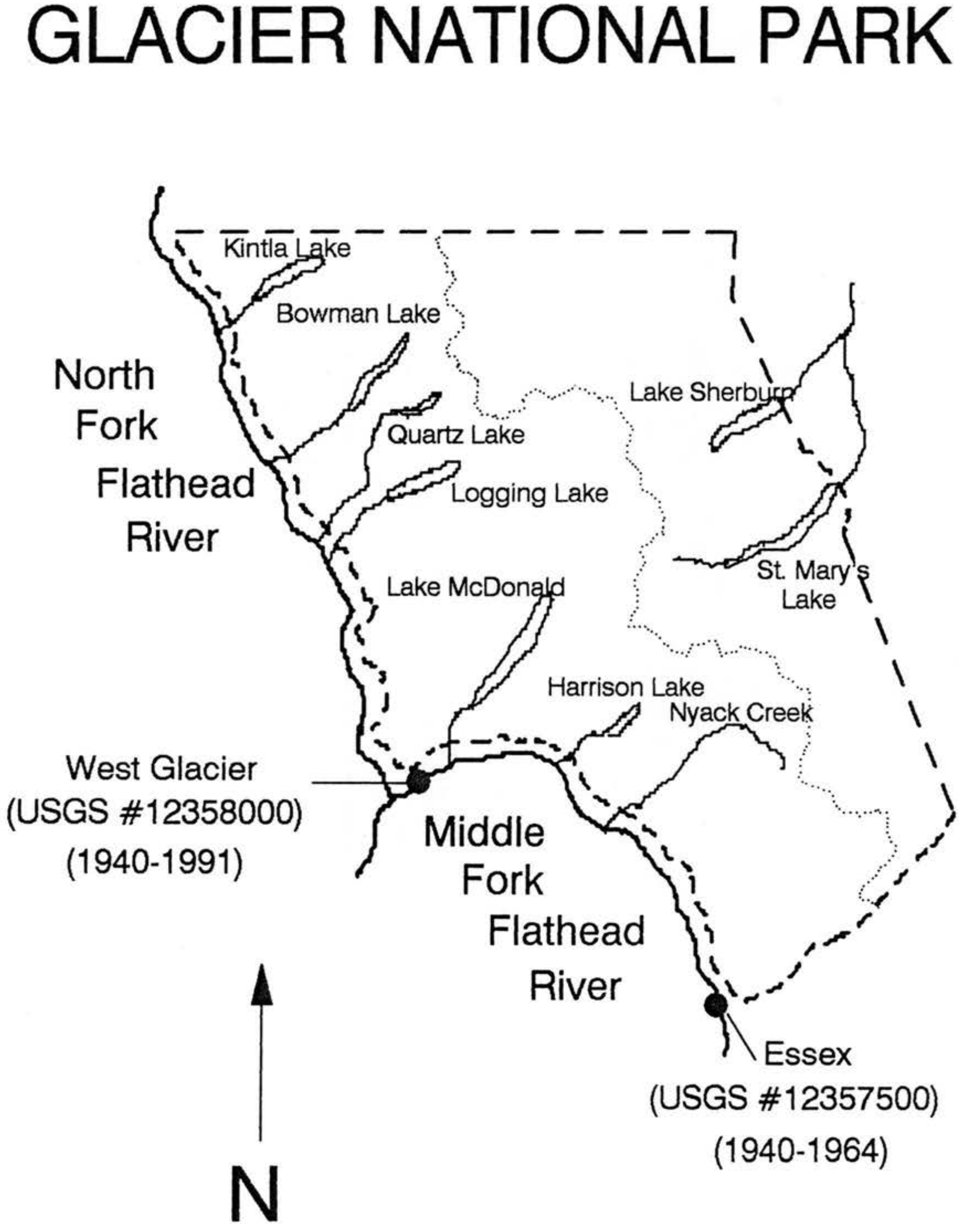

Figure 3. Glacier National Park, Montana.

drier lowlands receive 18 to 30 inches per year (USDA-SCS 1977). The climate is characterized by moderately cool weather throughout the year with the mean annual temperature ranging from 39 to 46 degrees Fahrenheit.

In general, the forests of Glacier National Park are typical of those of the Northern Rocky Mountain Region (Robinson 1956). The warm moist climate on the west side of the park promotes dense forests of western larch (Larix occidentalis[1]), western hemlock (Tsuga heterophylla), spruce (Picea engelmannii x glauca) (Habeck and Weaver 1969), subalpine fir (Abies lasiocarpa), and lodgepole pine (Pinus contorta). The east side experiences a rain shadow effect, creating semi-arid conditions which support vegetation that generally resembles that of the southern Rocky Mountains. The lack of moisture, coupled with high winds and colder temperatures, makes conditions much less favorable for tree growth (Robinson 1956). This area is characterized by lodgepole pine, ponderosa pine (Pinus ponderosa), and Douglas fir (Pseudotsuga menziesii).

The Middle Fork drainage supports a wide variety of plant community types. For the most part, these plant communities, and the riparian zone in general, remain relatively free from anthropogenic disturbance. There are, however, a few notable exceptions: a railroad and US Highway 2 parallel much of the lower half of the river, inholdings of private land exist throughout the valley, and cattle grazing occurs on some of the adjacent National Forest and private land. The majority of this activity, however, is restricted to the southern or left (oriented downstream) bank, and little, if any, activity occurs on river islands or the right bank where the study site was located.

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[1]Except as noted, nomenclature is taken from Lesica (1985), which follows Hitchcock and Cronquist (1973).

Floodplains along the Middle Fork are dominated by extensive forests of black cottonwood (Populus trichocarpa) and spruce, with Douglas fir, subalpine fir, western red cedar (Thuja plicata), western hemlock, and western white pine (Pinus monticola) scattered throughout. The complex deciduous shrub layer is typically a mixture of willow (Salix spp.), thin-leafed alder (Alnus incana), red-osier dogwood (Cornus stolonifera), snowberry (Symphoricarpos albus), Canadian buffaloberry (Shepherdia canadensis), dwarf huckleberry (Vaccinium caespitosum), and Rocky Mountain maple (Acer glabrum). The herbaceous layer is composed of an abundant mixture of annual and perennial grasses and forbs. A complete list of all riparian plant species observed in the Middle Fork valley can be found in Appendix A.

Hansen et al. (1988) developed a riparian classification system for Montana based on existing dominant vegetation (or dominant types). Accordingly, much of the vegetation along the Middle Fork would fall into the following riparian dominance types: *Picea engelmannii* (Engelmann Spruce), *Populus trichocarpa* (Black Cottonwood) or one of ten *Salix* (Willow) dominance types. The reader is referred to Hansen (1988) for a complete description of each of these riparian classifications.

Geology and Soils

The Middle Fork valley was formed by faulting along the Lewis Overthrust Fault, a single continuous fracture which parallels the eastern edge of the park and extends from the international boundary southward. This faulting produced a graben-like depression running in a northwesterly direction which later filled with sediment. Today, the Middle Fork occupies this faulted and filled depression which is frequently intersected by several intervening hills of hard rock (Ross 1959).

Subsequent glaciation and alluviation carved out portions of this sediment, leaving glacial deposits overlying finer sediments, and forming benches of varying height along the floodplain (Allen 1980). Through erosion and deposition, the river is constantly changing the shape and form of the channel and adjacent floodplain. This dynamic environment produces a mosaic of vegetation throughout the alluvial zone that is continually being reworked and restructured. The vegetation, in turn, becomes a variable influencing erosional and depositional processes.

Hydrology

The Middle Fork originates in the Bob Marshall Wilderness and flows through the Great Bear Wilderness for approximately 37 miles. Fifty-four miles of the lower Middle Fork form the boundary between Glacier National Park and the Flathead National Forest.

The Middle Fork is snowmelt-dominated with peak flows occurring in spring, usually during late May or early June, and low flows occurring in late fall and winter. Above average snowpacks coupled with warm springtime temperatures and periods of rain can result in severe flooding as occurred in 1964 and 1975 (Allen 1980). According to the United States Geological Survey (USGS) stream gaging records, the Middle Fork near West Glacier drains an area of 1128 square miles and has a mean annual discharge of 2948 cubic feet per second (cfs) for the 49 year period of record from 1939 to 1988 (Shields et al. 1989).

Study Site

Reconnaissance float trips and field surveys were conducted in June 1989 to identify potential study reaches within the Middle Fork Valley. The National Park Service selected the Nyack Flats area (Figure 4) as the

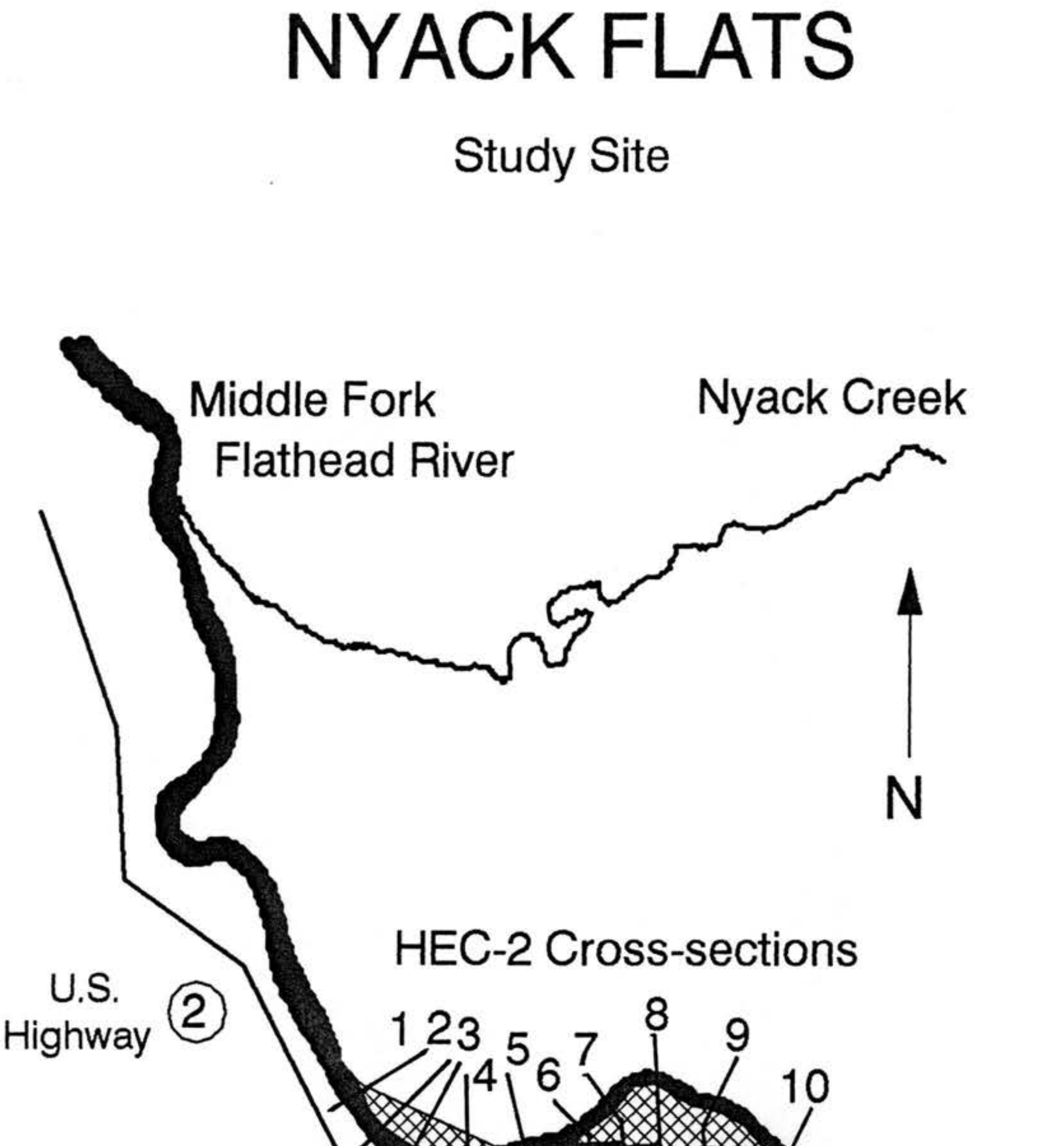


Figure 4. Nyack Flats study site.

principal study reach in which to focus their research efforts. The Park Service viewed the Nyack area as the most favorable study site along the Middle Fork (within Glacier National Park) because it provided them an opportunity to coordinate their research efforts with ongoing research being conducted by the University of Montana. The abundance of existing background data concerning the dynamics and biota of the hyporheic, zoobenthic and aquatic communities in the Nyack area further supported their choice.

Nyack Flats is a broad alluvial valley bounded both upstream and downstream by outcrops of bedrock substrata. The area is located at the confluence of Nyack creek and the Middle Fork Flathead River, about five miles upstream from West Glacier, Montana. The Nyack floodplain is characteristic of floodplains that occur repeatedly within the longitudinal gradient of the Middle Fork of the Flathead River.

The Middle Fork is predominantly a gravel-bed river which for most of its length flows through a long narrow valley. The average drop in gradient is approximately 33 feet per mile (Ross 1959). This narrow confined valley is repeatedly interrupted by extensive alluvial floodplains composed primarily of gravels and cobbles. Much of this floodplain alluvium is highly porous and saturated with water. These unconfined alluvial aquifers, characterized by substantial interstitial flow of water, receive and contribute water to the main channel.

The actual study site was located just upstream of the confluence of Nyack Creek and the Middle Fork of the Flathead River (Figure 4). Vegetation transects and hydraulic cross-sections were located just upstream of the bedrock substrata that defines the upper end of the alluvial floodplain. Locating these transects and cross-sections upstream from the alluvial floodplain, in the narrow, confined valley where groundwater-surface water interactions are minimized, allowed for more accurate discharge measurements and hydraulic modeling. Focusing on naturally confined areas close to the active channel, rather than the broad alluvial floodplain at Nyack Flats, provided a better correlation between flows (i.e., surface water) and riparian vegetation. With increasing distance from the active channel, other factors (e.g., groundwater, light availability, substrate, soil development, plant interactions, successional processes) begin to play a larger role in dictating and influencing the distribution of riparian vegetation.

METHODS

Study Design

To understand and relate riparian vegetation patterns to streamflow, it is essential to review and synthesize the information which forms the basis for this type of analysis. It is quite evident that streamside vegetation occurs in linear zones parallel to the longitudinal axis of the stream, and casual observations of vegetation in riverine habitats often support this. Close to the active channel, vegetation is often absent, or comprised of annual grasses and forbs, or shrub species that are well adapted to intense physical battering, high velocities and shear stresses associated with frequent flooding and prolonged inundation. With increasing distance from, and/or elevation above, the channel, structural complexity and species richness often increases until the riparian zone ends and upland vegetation is encountered. Harris (1987) suggested that this pattern is related to environmental gradients created by the stream itself.

The principal focus of this study was to relate gradients of flood intensity, magnitude, and/or duration to the existing pattern or distribution of riparian vegetation along the Middle Fork of the Flathead River. Vegetation patterns were determined through review of historical aerial photographs and from species abundance as observed in transects located perpendicularly to the river. These vegetation transects consisted of a continuous series of plots centered over hydraulic cross-sections. Landform type (following Osterkamp and Hupp 1984), substrate, and position with respect to the thalweg (i.e., the longitudinal line connecting points of minimum bed elevation along the streambed (Bovee and Milhous 1978)) was recorded for each plot along a transect.

Flood frequency and flow duration curves for the Middle Fork of the Flathead River were developed from existing stream gage data collected at the West Glacier (USGS ID# 12358500) and Essex (USGS ID# 12357000) stream gaging stations (Figure 3). Area-weighted discharge relationships and correlation with point-discharge measurements taken at the study site were used to estimate similar flow characteristics of the Middle Fork at the Nyack study site. A hydraulic model was calibrated and used to predict the water surface elevation associated with different discharges at each plot along the transects. From these, stage-discharge relationships were developed for each cross-section to determine the minimum discharge required to inundate each plot. The corresponding fraction of time that discharge was greater than or equal to this minimum inundating discharge was calculated from the flow-duration curve. The hydroperiod (i.e., fraction of time inundated) was then divided into nine inundation classes and each plot assigned to one of these nine inundation classes. The end product of the hydrologic analysis was a set of hydrologic characteristics that described each plot in terms of the minimum discharge required to inundate the plot, and the fraction of time that it was inundated.

Species distribution patterns, dominant cover types and key indicator species were identified using TWINSPAN (TWo-way INdicator SPecies ANalysis). TWINSPAN (Hill 1979) is a clustering program that groups stands or plots with similar composition together and species with similar distributions together. Each plot was assigned to one of four identified cover types. The end product of the vegetation analysis was a set of vegetation characteristics describing each plot in terms of a dominant cover type and the presence, or absence, of key indicator species.

The final step in the data analysis was to array the plots across a hydrologic gradient (represented as a set of inundation classes), and determine the likelihood, or probability, that a plot falling in a particular inundation class belongs to a particular cover type.

Field Methods and Procedures

Initial field reconnaissance of the study reach in late May and early June of 1989 and 1990 revealed two sites with extensive streamside riparian vegetation that were suitable for conducting hydrologic measurements. Ten hydraulic cross-sections were selected (Figure 4) along the Nyack study reach. Selected cross-sections represented a range of geomorphic landforms, hydrologic conditions and riparian vegetation. They were located according to the guidelines and recommendations outlined in the HEC-2 users manual (USDI-ACE 1990) and Hoggan (1989). HEC-2 is a computer simulation technique that estimates water surface elevations and associated inundation areas for selected discharges. It was developed for calculating water surface profiles for steady, gradually varied flow in natural or constructed channels (Hoggan 1989). A detailed description of the HEC-2 model is given in Appendix B. Cross-sectional geometry of each cross-section was surveyed using a Lietz total station instrument. Other HEC-2 parameters (e.g., Mannings "n", cross-sectional width, overbank and channel distances between transects, water surface elevations) were estimated or measured, and recorded.

Stream discharge measurements were taken periodically throughout the 1990 and 1991 summer seasons (Appendic C) at the downstream-most cross-sections using standard USGS boat discharge measurement techniques (Rantz 1982a and 1982b). Corresponding water surface elevations associated with selected discharge measurements were recorded at each cross-section. This information was used to calibrate the HEC-2 model, and to relate measured flows at the study site to concurrent measurements/estimates of discharge at the USGS stream gaging station at West Glacier.

Vegetation data was collected on six belt transects oriented perpendicularly to the river. These transects were centered over six of the ten HEC-2 transects, thus facilitating estimation of plant position with respect to the channel. Vegetation transects 1, 2, and 3 were located on the point bar (Figure 4) and centered on HEC-2 cross-sections 2, 3, and 4 respectively. The remaining three vegetation transects (4, 5, and 6) were located on the island (Figure 4) and centered on HEC-2 cross-sections 7, 8, and 9 respectively. Vegetation transects were 5 meters (m) wide and surveyed at 5 m intervals to determine horizontal distance from, and elevation above, the thalweg. A wooden stake marked the center of each plot, and the entire plot was assumed to have the same elevation as the plot center. Transects therefore consisted of a continuous series of 5 m by 5 m plots centered on the stakes and extending outward from the channel into the upland unflooded areas (Figure 5).

Within each 5 m by 5 m plot (Figure 6), species, diameter, height, rooted substrate, landform type and position with respect to the channel was recorded on a field data sheet (Figure 7) for all seedlings, saplings, and trees. For the purposes of this study, seedlings were defined as trees less than 1.0 inch in diameter and less than 3.3 feet tall, and saplings as trees less than 1.0 inch in diameter and greater than 3.3 ft tall. The above seedling definition follows generally accepted standards used in forestry and related disciplines (Sharpe et al. 1976). Saplings, however, are usually defined as all trees with a diameter at breast height less than 4.0 inches and ranging from 3 to 10 feet tall; trees are usually

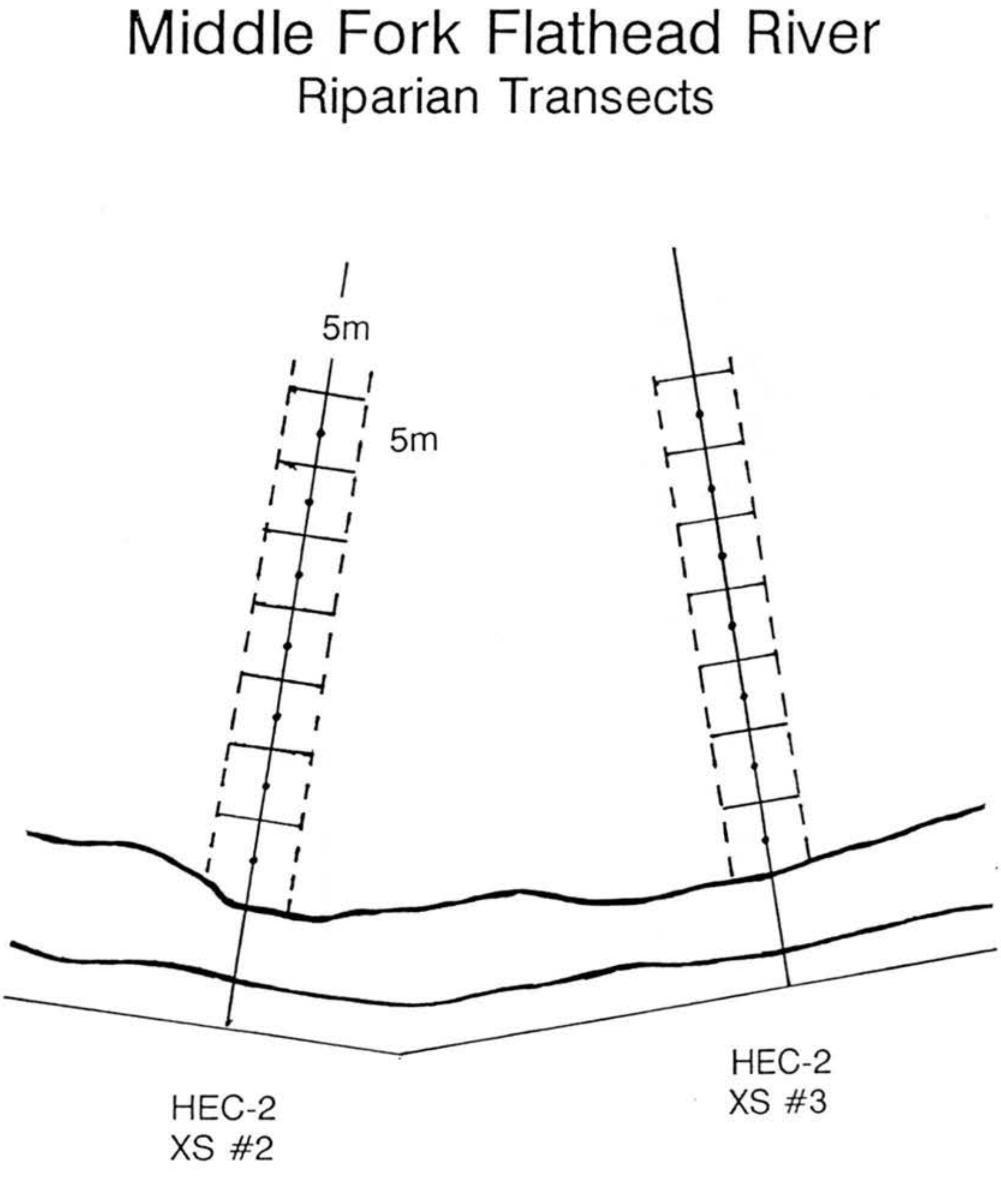
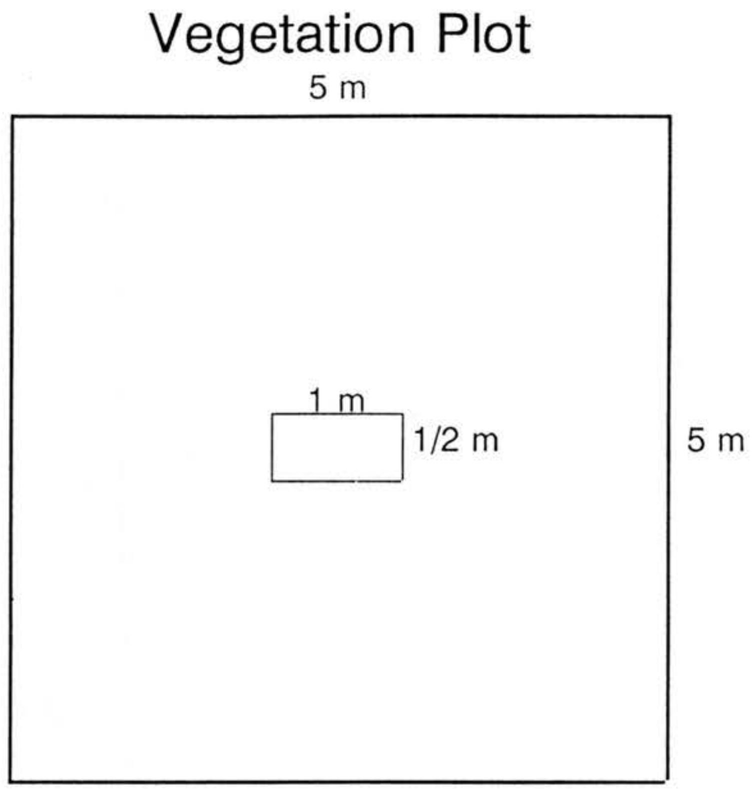


Figure 5. Example of riparian transects oriented perpendicularly to the river and extending outward from the channel into surrounding upland areas.



TREES	SHRUBS	HERBS
Density (by size class)	Density	Presence/Absence
Height	% Absolute Cover	% Absolute Cover
Age		
# Dead Stems		

Figure 6. Close-up of a typical riparian plot. Herbaceous data was collected in the 1/2 m by 1 m frame; all shrub and tree data was collected within the 5 m by 5 m plot.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: ______ OBSERVER: ______
PLOT NUMBER: ______ DATE: ______

ELEVATION: ______
DISTANCE: ______
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank
___ channel shelf ___ floodplain ___ upland

COMMENTS: ______

TREE SPECIES	NUMBER BY DBH (INCH) CLASS											
	0 - 0.99"		1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
	<3.3'	>3.3'										
	[1]	[2]										[3]

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet) [4]	COVER CLASS [5]	GRASS FORB	COVER CLASS [5]	GRASS FORB	COVER CLASS [5]	OTHER	% COVER
								ROCK	
								B.G.	
								LITTER	
								MOSS	
								OTHER	

1- Total # of dead trees w/in each size class
2- Record average tree height for each size class.
3- For trees > 25" DBH record individual tree diameter.
4- Intercepted length of shrub canopy in feet.
5- % cover is % absolute cover, put actual % in ( )'s.
*- record tree age, dbh + ht of individual trees w/in plot.

Figure 7. Riparian survey form.

defined as having a diameter at breast height greater than or equal to 4.0 inches (Sharpe et al. 1976).

For all shrubs within each plot the following was recorded: number of plants by species, rooted substrate, landform type, and position with respect to the channel. Absolute cover for each species was recorded as the intercepted distance along a measuring tape centered on the belt-transect. Percent absolute cover was visually estimated and recorded according to the cover classes of Daubenmire (1959).

Presence/absence data and absolute cover of all herbaceous vegetation was recorded, by species, within a one-half by one meter square quadrat centered on each stake. Percent absolute cover was visually estimated and recorded according to the same cover class codes used for the shrub community (Appendix D). Rooted substrate, landform type, and position of each quadrat relative to the channel were also recorded. All field data, including discharge measurements and riparian survey forms are included in Appendices C and D.

Data Analysis

HYDROLOGY

The northwest region of Montana often experiences extreme rain-caused floods in addition to those caused by snowmelt, or snowmelt coupled with rain. As seen in Figure 8, these rain-caused events occur less frequently and are significantly larger than snowmelt floods, and result in a dog-legged discharge frequency curve. Omang et al. (1986) found it difficult to fit a log-Pearson type III distribution to this data, and consequently developed separate discharge frequency curves for those events caused by intense rains or snowmelt mixed with rain and those caused by snowmelt alone, using the procedures outlined in the U.S. Water Resources Council

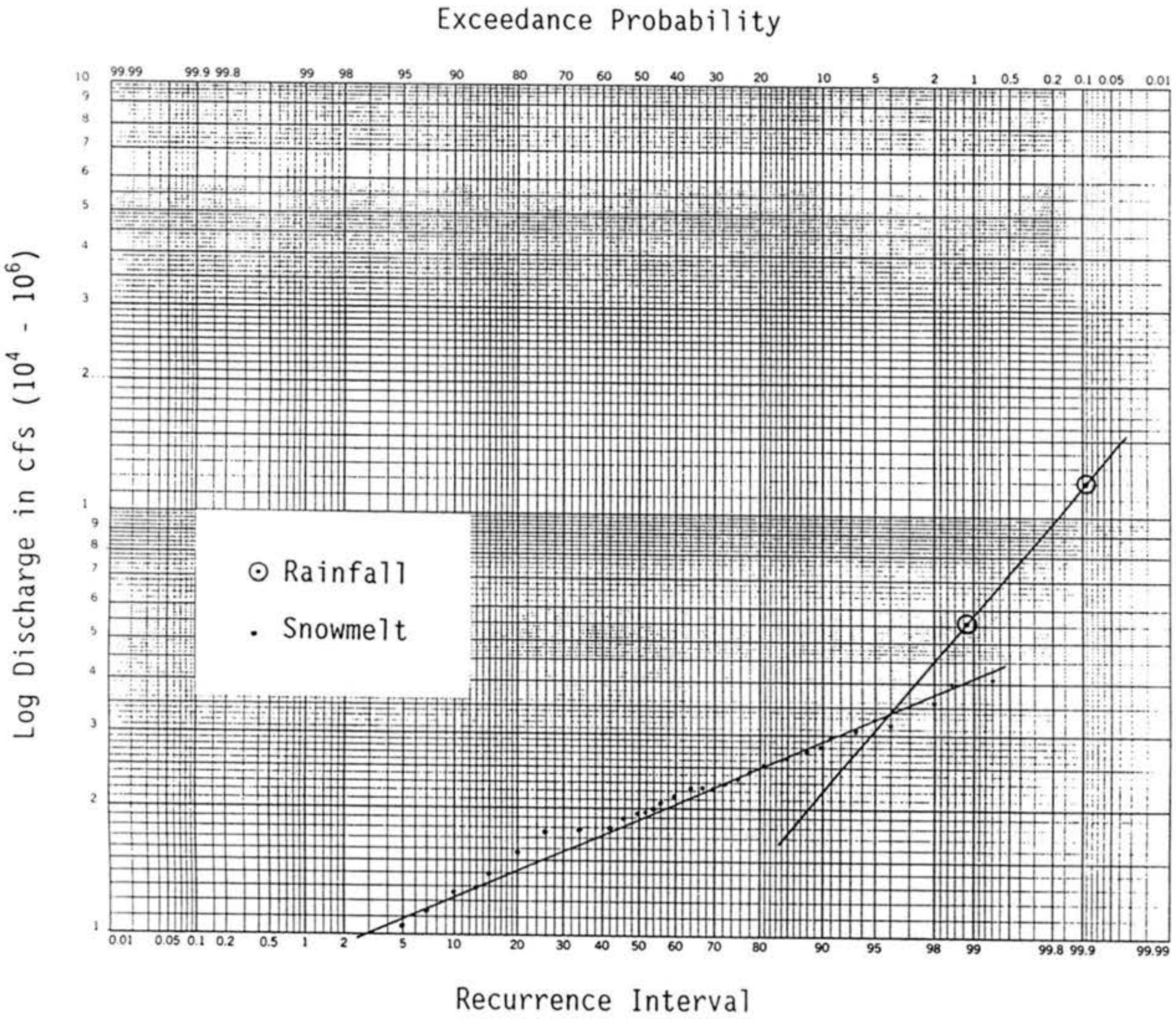


Figure 8. Probability distribution function relating discharge (cfs) and frequency of occurrence for the Middle Fork Flathead river at West Glacier, Montana (after Waltemeyer and Shields 1982).

Bulletin 17B (1981). They then combined these two curves using procedures developed by the U.S. Army Corps of Engineers (USDI-ACE 1958) to produce a single probability distribution function relating discharge and frequency for the period of record at the USGS gage at West Glacier and Essex (Figure 8). Standard USGS output from these curves is presented in Tables 1 through 4. These tables give the magnitude and probability of instantaneous peak flows and annual high flows for the period of record at the respective gaged sites.

Table 1. Magnitude and probability of instantaneous peak flow based on period of record 1939-1978: Middle Fork Flathead at West Glacier, Montana, USGS ID# 12358500 (after Waltemeyer and Shields 1982).

Discharge in cubic feet per second (cfs) for indicated recurrence interval, in years, and annual exceedance probability, in percent.

1.25 80%	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
17800	21900	28500	34000	41200	48300	62700

Table 2. Magnitude and probability of annual high flow based on period of record 1940-1979: Middle Fork Flathead at West Glacier, Montana, USGS ID# 12358500 (after Waltemeyer and Shields 1982).

Period (Consecutive Days)	Discharge, in cfs, for indicated recurrence interval, in years, and annual exceedance probability, in percent.				
	2 50%	5 20%	10 10%	25 4%	50 2%
1	18800	28100	36000	48700	60300
3	18400	25600	30700	37400	42600
7	16900	22200	25300	28800	31100
15	15100	19400	21700	24100	25600
30	13400	16600	18100	19600	20400
60	10900	13100	14100	15000	15500
90	8850	10600	11300	12000	12300

Table 3. Magnitude and probability of instantaneous peak flow based on period of record 1940-1964: Middle Fork Flathead at Essex, Montana USGS ID# 12357000 (after Waltemeyer and Shields 1982).

Discharge in cubic feet per second (cfs) for indicated recurrence interval, in years, and annual exceedance probability, in percent.

1.25 80%	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
7600	9650	13500	16200	20500	24000	31700

Table 4. Magnitude and probability of annual high flow based on period of record 1940-53, 1957-64: Middle Fork Flathead at Essex, Montana USGS ID# 12357000 (after Waltemeyer and Shields 1982).

Period (Consecutive Days)	Discharge, in cubic feet per second (cfs), for indicated recurrence interval,in years, and annual exceedance probability, in percent.				
	2 50%	5 20%	10 10%	25 4%	50 2%
1	7950	12300	16200	22500	-----
3	7650	11100	13600	17200	-----
7	7130	9570	11000	12500	-----
15	6300	8270	9280	10300	-----
30	5510	7010	7720	8390	-----
60	4300	5380	5870	6320	-----
90	3360	4200	4580	4930	-----

Streamflow estimates at the study site were made using the drainage-area transfer method developed by Parrett and Omang (1981) and Parrett and Cartier (1989). Omang et al. (1986) developed equations to estimate flood magnitudes with 1.25, 2, 5, 10, 25, 50, and 100 year recurrence intervals for ungaged, unregulated streams in Montana. These equations relate basin characteristics (e.g., drainage area, mean basin elevation, mean annual precipitation, mean channel slope) to known flood magnitudes and frequencies at gaged sites. Table 5 lists these equations for the northwest region of Montana.

Table 5. Flood-frequency equations based on basin characteristics for the northwest region of Montana - 26 stations (after Omang et al. 1986); A, drainage area; P, mean annual precipitation; Gf, geographical factor.

Discharge (in cubic feet per second for given exceedance probability)		Equations	Recurrence Interval (years)
$Q_{50\%}$	=	$0.343\ A^{0.89}\ P^{1.12}\ G_f$	2
$Q_{20\%}$	=	$3.230\ A^{0.82}\ P^{0.72}\ G_f$	5
$Q_{10\%}$	=	$11.10\ A^{0.78}\ P^{0.51}\ G_f$	10
$Q_{4\%}$	=	$36.30\ A^{0.75}\ P^{0.32}\ G_f$	25
$Q_{2\%}$	=	$54.20\ A^{0.73}\ P^{0.34}\ G_f$	50
$Q_{1\%}$	=	$75.20\ A^{0.71}\ P^{0.39}\ G_f$	100

For all regions in Montana they found drainage area to be the most significant basin characteristic influencing discharge magnitude and frequency. They further suggested that flood magnitudes for an ungaged stream could be found using the drainage-area transfer method (Equation 1), when the area of the ungaged drainage basin was within 50 percent of the gaged drainage. This method is based on the drainage-area ratio of the ungaged site to the gaged site.

$$Q_u = (A_u/A_g)^a Q_g \qquad (1)$$

where: Q_u= estimated flood magnitude for a given exceedance probability at the ungaged site.

Q_g= flood magnitude for a given exceedance probability at the gaged site.

A_u= drainage area of the ungaged site.

A_g= drainage area of the gaged site.

a = exponent of drainage area developed for that region of Montana (Omang et al. 1986).

Recall that the Middle Fork Flathead River near Glacier National Park is gaged at two different locations, one below or downstream of the study site (near West Glacier), and one above or upstream of the study site (at Essex) (Figure 3). By using Equation 1 above, it was possible to relate flood magnitudes (with the same exceedance probabilities) at West Glacier (Q_{WG}) to those at Essex (Q_{EX}). Hence, knowing Q_{WG} and Q_{EX} and the respective drainage basin areas (A_{WG} = 1128 square miles and A_{EX} = 510 square miles) it was possible to solve for the exponent term, "a", in Equation 2 for recurrence intervals of 1.25, 2, 5, 10, 25, 50, and 100 years. That is:

$$a = \frac{\ln (Q_{EX}/Q_{WG})}{\ln (A_{EX}/A_{WG}).} \qquad (2)$$

Then, using Equation 1, these exponents were used to solve for values of Q_u at the study site (i.e., Q_{SS}) which has a drainage area of 755 square miles. The idea is that the drainage area transfer method will give more reliable results when the area exponents that are used are those developed specifically for the Middle Fork of the Flathead River, rather than the average "a" of the 26 stations located throughout the northwest region of Montana as in Omang et al. 1986 (Parrett 1991, personal communication).

The Middle Fork of the Flathead is unregulated for its entire length and the ratio of the ungaged basin of the study site to the gaged basin at West Glacier is easily within the required 50 percent (755/1128 = 66.9%). Table 6 shows the magnitude and probability of instantaneous peak discharges at the study site as determined from Equation 1.

Table 6. Magnitude and probability of instantaneous peak discharges for the Middle Fork Flathead River at Nyack Flats study site. Discharge in cubic feet per second.

Recurrence Interval (years)	Exceedance Probability (%)	West Glacier (Q_{WG})	Essex (Q_{EX})	Area Exponent (a)	Study Site (Q_{SS})
1.25	80%	17800	7600	1.0721	11574
2	50%	21900	9650	1.0324	14469
5	20%	28500	13500	0.9413	19531
10	10%	34000	16200	0.9339	23369
25	4%	41200	20500	0.8793	28945
50	2%	48300	24000	0.8811	33910
100	1%	62700	31700	0.8592	44407
Maximum Discharge of Record		140000	75300	0.7813	102307

Using the duration tables for mean daily flow developed by the USGS for both West Glacier and Essex (Tables 7 and 8) it would have been possible to construct a flow duration table for the study site at Nyack using Equations 1 and 2. This would have produced a flow duration table of only 17 flow values, with none greater than 12500 cfs, and times of inundation ranging from 1 to 99.9 percent. Preliminary data analysis revealed that the minimum inundating discharge of several of the plots was greater than 12500 cfs which indicated a percentage of time inundated much less than 1.0. It was therefore necessary to construct a separate flow

Table 7. Duration table of mean daily flow for period of record 1940-1979, Middle Fork Flathead, West Glacier, Montana USGS ID# 12358500 (after Waltemeyer and Shields 1982).

Discharge, in cfs, which was equaled or exceeded for indicated percent of time																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
19000	12600	8850	6370	4540	2240	1470	1090	851	689	560	447	384	325	293	275	225

Table 8. Duration table of mean daily flow for period of record 1940-53, 1957-64, Middle Fork Flathead, Essex, Montana USGS ID# 12357000 (after Waltemeyer and Shields 1982).

Discharge, in cfs, which was equaled or exceeded for indicated percent of time																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
8180	5120	3330	2180	1430	664	434	326	261	216	182	143	124	107	97	83	55

duration curve to calculate the percent of time that stream discharge at the study site was greater than flows of 12500 cfs and larger. In order to construct this flow duration curve, however, it was first necessary to develop a synthetic record of mean daily flows at the study site.

Comparison of mean annual precipitation, mean basin elevation, mean channel slope, drainage density, aspect, and other basin characteristics, revealed little difference between the watershed associated with the West Glacier site and the watershed associated with the Essex site. In fact, separated by only 26 miles, these two basins are very similar in all respects except drainage area. The basin areas associated with West Glacier and Essex are 1128 and 510 square miles respectively. Consequently, it was assumed that Equations 1 and 2 would still provide reasonable estimates of mean daily flows. Granted, these equations were initially developed to estimate discharge associated with low frequency, high magnitude events with specific recurrence intervals. However, given the close proximity of the two stations, the similarity and uniformity of their basins in terms of vegetation, climate, and soils, these systems tend to behave in a similar fashion on a day-to-day basis. Consequently, these systems would be expected to react similarly to individual storms and changing weather conditions with little lag-time of discharge pulses or flood waves between the two stations. In addition, daily fluctuations in discharge at either site would be expected to be small relative to overall discharge, or at the very least, be similar at the two stations relative to overall discharge.

Using Equation 2 and the common period of record between the West Glacier and Essex sites (1940-1964) it was possible to solve for the area exponent, "a", for a range of discharges. Mean daily flow data for the USGS gaging stations at West Glacier (ID # 12358500) and Essex (ID #

12357000) were obtained from the HYDRODATA™ (US WEST 1988) database (Appendix C) for each period of record. The flow record at West Glacier was divided into 100 cfs intervals for all flows less than 10000 cfs, into 1000 cfs intervals for flows between 10,000 and 24,999 cfs, and a last interval for all flows greater than or equal to 25000 cfs. Using the corresponding daily flow value at the Essex site, the average "a" or "a-value" was then computed for each of the 115 discharge classes (Table 9).

Table 9. Computed average area exponent (i.e., a-value) for daily discharges at West Glacier and Essex sites on the Middle Fork of the Flathead River, 1940-1964. Discharge in cubic feet per second.

Discharge Class	Discharge (cfs)	Average a-value
1	1 - 99	1.675
2	100 - 199	1.211
3	200 - 299	1.314
4	300 - 399	1.346
5	400 - 499	1.356
6	500 - 599	1.387
7	600 - 699	1.439
8	700 - 799	1.498
9	800 - 899	1.500
10	900 - 999	1.472
11	1000 - 1099	1.563
12	1100 - 1199	1.508
13	1200 - 1299	1.498
14	1300 - 1399	1.527
15	1400 - 1499	1.526
16	1500 - 1599	1.550
17	1600 - 1699	1.493
18	1700 - 1799	1.502
19	1800 - 1899	1.520
20	1900 - 1999	1.506
21	2000 - 2099	1.540
22	2100 - 2199	1.590
23	2200 - 2299	1.537
24	2300 - 2399	1.563
25	2400 - 2499	1.540
26	2500 - 2599	1.557
27	2600 - 2699	1.575
28	2700 - 2799	1.553
29	2800 - 2899	1.471
30	2900 - 2999	1.491
31	3000 - 3099	1.419
32	3100 - 3199	1.539

Table 9. Continued.

Discharge Class	Discharge (cfs)	Average a-value
33	3200 - 3299	1.616
34	3300 - 3399	1.489
35	3400 - 3499	1.400
36	3500 - 3599	1.497
37	3600 - 3699	1.381
38	3700 - 3799	1.442
39	3800 - 3899	1.314
40	3900 - 3999	1.515
41	4000 - 4099	1.452
42	4100 - 4199	1.414
43	4200 - 4299	1.523
44	4300 - 4399	1.464
45	4400 - 4499	1.489
46	4500 - 4599	1.401
47	4600 - 4699	1.489
48	4700 - 4799	1.391
49	4800 - 4899	1.403
50	4900 - 4999	1.375
51	5000 - 5099	1.382
52	5100 - 5199	1.376
53	5200 - 5299	1.358
54	5300 - 5399	1.345
55	5400 - 5499	1.380
56	5500 - 5599	1.323
57	5600 - 5699	1.355
58	5700 - 5799	1.408
59	5800 - 5899	1.362
60	5900 - 5999	1.307
61	6000 - 6099	1.313
62	6100 - 6199	1.308
63	6200 - 6299	1.231
64	6300 - 6399	1.261
65	6400 - 6499	1.333
66	6500 - 6599	1.345
67	6600 - 6699	1.257
68	6700 - 6799	1.182
69	6800 - 6899	1.252
70	6900 - 6999	1.293
71	7000 - 7099	1.399
72	7100 - 7199	1.191
73	7200 - 7299	1.280
74	7300 - 7399	1.389
75	7400 - 7499	1.273
76	7500 - 7599	1.227
77	7600 - 7699	1.386
78	7700 - 7799	1.133
79	7800 - 7899	1.219
80	7900 - 7999	1.194
81	8000 - 8099	1.442
82	8100 - 8199	1.214
83	8200 - 8299	1.311

Table 9. Continued.

Discharge Class	Discharge (cfs)	Average a-value
84	8300 - 8399	1.257
85	8400 - 8499	1.126
86	8500 - 8599	1.183
87	8600 - 8699	1.203
88	8700 - 8799	1.167
89	8800 - 8899	1.147
90	8900 - 8999	1.169
91	9000 - 9099	1.309
92	9100 - 9199	1.205
93	9200 - 9299	1.156
94	9300 - 9399	1.173
95	9400 - 9499	1.096
96	9500 - 9599	1.164
97	9600 - 9699	1.203
98	9700 - 9799	1.129
99	9800 - 9899	1.059
100	9900 - 9999	1.102
101	10000 - 10999	1.105
102	11000 - 11999	1.094
103	12000 - 12999	1.107
104	13000 - 13999	1.063
105	14000 - 14999	1.054
106	15000 - 15999	1.017
107	16000 - 16999	1.048
108	17000 - 17999	1.076
109	18000 - 18999	1.019
110	19000 - 19999	0.979
111	20000 - 20999	1.100
112	21000 - 21999	0.985
113	22000 - 22999	1.021
114	23000 - 23999	1.031
115	24000 +	1.142

These average "a-values" were then used in Equation 1 to predict mean daily flow at the study site (Q_{SS}) from the long term record of mean daily flow at West Glacier (Q_{WG}). To test this method of predicting flow at an ungaged site, the average "a-values" were used to predict the mean daily flow at Essex from the mean daily flow at West Glacier for the period of record 1940-1964. Simple linear regression and analysis of variance (ANOVA) of the predicted values (Q_{PRED}) on the actual observed discharge values (Q_{EX}) produced an adjusted $R^2 = 0.981$ (p-value < 0.000), and a F-ratio = 424153.424 (p-value < 0.000) (Table 10). It is important to note that the results of the R^2 could be misleading because this only indicates that the two flows are strongly correlated. Note that the coefficient (i.e., slope of the line) of the independent variable (i.e., observed flow at Essex) is very close to 1.0 (coefficient = 0.972). This indicates that not only are the two flows strongly correlated, but that the predicted flows are, in fact, very close to the actual flows.

Comparison of point-discharge measurements taken at the study site with the USGS streamflow measurements taken at West Glacier and Essex during the same time period were also used to check the accuracy of the drainage-area transfer method (Table 11).

Table 10. Simple linear regression and analysis of variance of predicted mean daily discharge (Q_{PRED}) on observed mean daily flow at Essex (Q_{EX}). Middle Fork Flathead River, Montana.

Dependent Variable: Q_{PRED}

Multiple R: 0.991
Squared Multiple R: 0.981
Adjusted Squared Multiple R: 0.981

Variable	Coefficient	Std Error	Std Coeff	Tolerance	T	P(2 tail)
Q_{EX}	0.972	0.001	0.991	1.000	651.27	0.000

ANALYSIS OF VARIANCE

Source	Sum-of-squares	df	Mean-square	F-ratio	P
Regression	3.36 E+10	1	3.36 E+10	424153.42	0.000
Residual	6.46 E+08	8157	79194.199		

Table 11. Comparison of observed point-discharge measurements taken at the Nyack study site with estimate discharges for the same date using Equation 1. Discharge is in cfs.

Date	Q_{WG}	Average a-value	Estimated Discharge	Measured Discharge
July 15, 1990	5030	1.382	2888	2273
July 23, 1990	2920	1.491	1605	1205
Sept 1, 1990	1110	1.508	605	565

From the synthetic flow record it was then possible to construct a flow duration curve using mean daily flows at the study site (Figure 9). A statistical software package, SYSTAT (the SYstem for STATistics) (SYSTAT 1990), was used to fit a non-linear model to the flow duration curve. The non-linear estimation procedure used in SYSTAT uses the Quasi-Newton minimization method to determine the line of best fit. The model was of the form:

$$Y = A * \exp(-B * X) + C/X \quad (3)$$

where: A, B, C = constants
Y = fraction of time inundated
X = discharge

The actual non-linear model relating percent of time flow is equaled or exceeded to discharge is given by:

$$TIME = 0.446 * \exp(-0.035 * Q) + 0.724/Q \quad (4)$$

where: Q = mean daily discharge at the study site (in cfs) / 100.00
TIME = fraction of time discharge is > or = Q.

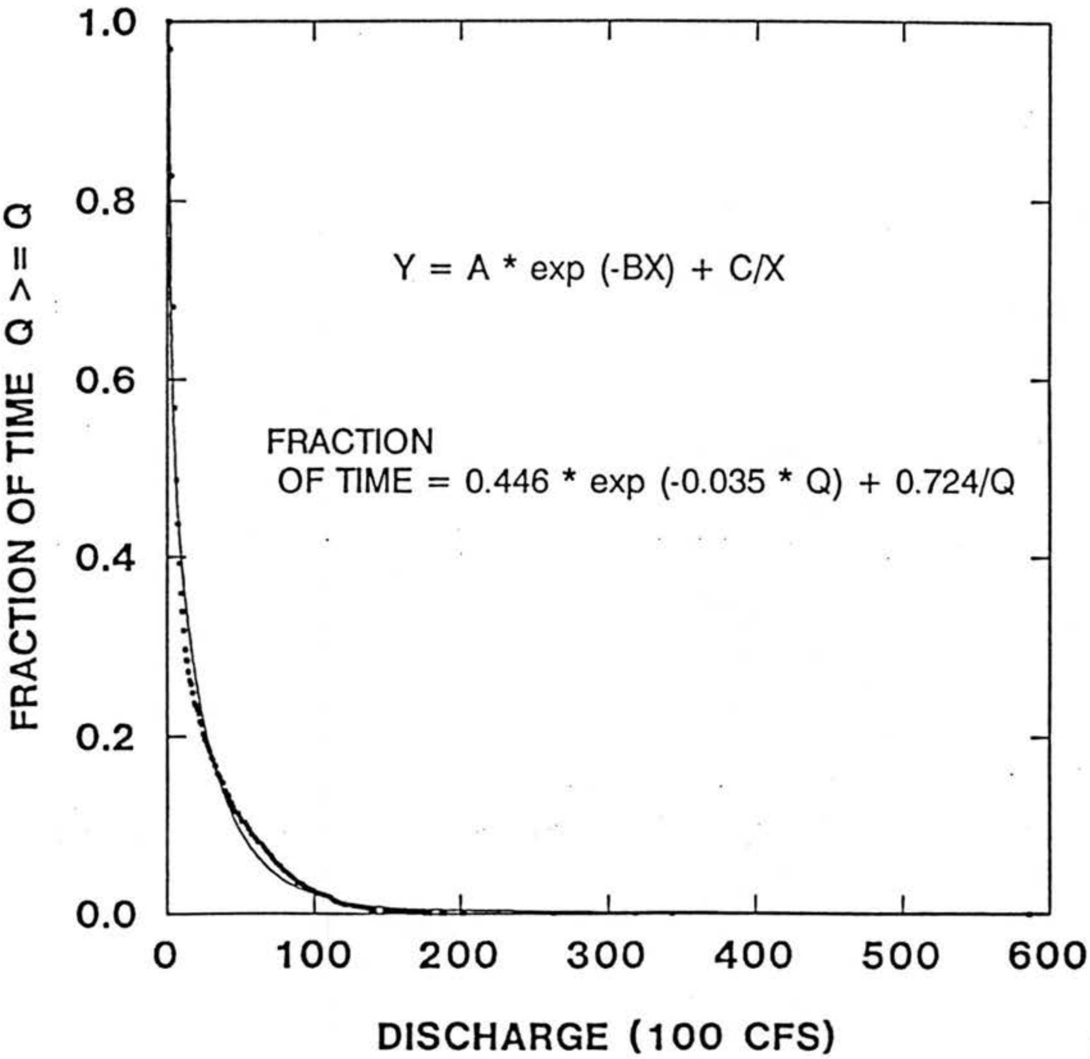


Figure 9. Flow duration curve of mean daily flows, for Middle Fork Flathead River at Nyack Flats, Montana.

Results of the non-linear regression are shown in Table 12. The regression coefficient (adjusted R^2 value) is 0.965 which indicates a relatively good fit with more than 95 percent of the variance in the fraction of time accounted for by the variation in discharge. Once the minimum discharge required to inundate each plot was known, the equation of the flow duration curve was used to predict the corresponding fraction of time each plot along a transect was inundated.

Table 12. Non-linear regression relating percent or fraction of time (TIME) flow is greater than or equal to a given discharge (Q). Nyack Flats study site, Middle Fork Flathead River, Montana.

Dependent variable: TIME

Source	Sum-of-squares	df	Mean-square
Regresssion	5.743	3	1.914
Residual	0.149	159	0.001
Total	5.893	162	
Corrected	4.225	161	

Raw R-squared (1 - residual/total) = 0.975
Corrected R-squared (1 - residual/corrected) = 0.965

HEC-2 was used to estimate water surface elevations and associated inundation areas for selected discharges. HEC-2 was developed for calculating water surface profiles for steady, gradually varied flow in natural or constructed channels (Hoggan 1989). Water surface profiles were computed at each cross-section using the standard step method, which sequentially solves the one-dimensional energy equation between adjacent cross-sections (Hoggan 1989). Sub-critical flow was modeled, and computed water surface elevations were compared to known, observed water surface elevations associated with discharge measurements taken periodically throughout 1990 and 1991. This procedure was used to calibrate the model at measured discharges of 1200 cfs and 13200 cfs. Data inputs, and model parameters were adjusted accordingly to obtain the smallest difference between computed water surface elevations and observed water surface elevations, as well as the fewest number of conveyance errors. Table 13 compares computed water surface elevations to known or observed water surface elevations at the two measured discharges.

Table 13. Comparison of computed water surface elevations (from HEC-2 Analysis) to actual surveyed water surface elevations associated with discharges of 1200 and 13200 cubic feet per second. Elevations given as feet above mean sea level.

Discharge = 1200 cfs

Cross-section Number	Computed water surface elevation	Surveyed water surface elevation	Difference (computed - surveyed)
1	3358.91	3358.91	0.00
2	3359.55	3359.38	+0.17
3	3361.03	3360.61	+0.42
4	3362.75	3362.33	+0.42
5	3369.05	3368.91	+0.14
6	3369.89	3369.93	-0.04
7	3371.01	3371.48	-0.47
8	3371.35	3371.59	-0.24
9	3373.09	3373.69	-0.60
10	3377.10	3377.33	-0.23

Discharge = 13200 cfs

Cross-section Number	Computed water surface elevation	Surveyed water surface elevation	Difference (computed - surveyed)
1	3363.24	3363.24	0.00
2	3364.52	3364.42	+0.10
3	3366.49	3366.61	-0.12
4	3367.61	3367.88	-0.27
5	3373.86	---	---
6	3375.87	3375.52	+0.35
7	3376.42	3375.76	+0.66
8	3376.46	3375.84	+0.62
9	3378.75	3378.90	-0.15
10	3382.11	3382.30	-0.19

HEC-2 was then used to model water surface profiles associated with discharges of 1200, 2000, 4000, 6000, 8000, 10000, 11575, 13200, 14470, 19530, 23370, 28945, 33910, and 44410 cfs. The last eight values correspond with the 1.25, 2, 5, 10, 25, 50, and 100 year recurrence intervals, except for 13200 cfs which was one of the measured discharges. These eight values coupled with additional discharges ranging from 2000 to 10000 cfs were used to produce a stage-discharge relationship at each cross-section (Figures 10-15). Non-linear estimation was again used to fit a curve of best fit to the stage-discharge curve at each cross-section (Table 14). The model was of the form:

$$Y = A * \exp (B * X) - C \qquad (5)$$

where: A, B, C = constants
Y = discharge
X = stage or elevation

From these equations it was then possible to estimate the minimum discharge required to inundate each plot along a belt transect. Recall that the minimum inundating discharge is that discharge which produces a water surface elevation equal to the surveyed ground elevation at plot center. The elevation of each plot was used in the stage-discharge equations to determine the minimum inundating discharge. This minimum inundating discharge was then used in the equation of the flow duration curve to predict the fraction of time that the inundating discharge was equaled or exceeded.

The hydroperiod, or percent of time inundated, was divided into nine inundation classes with each of the 198 plots falling into one of these nine inundation classes. The hydroperiod was divided so that an equal, or

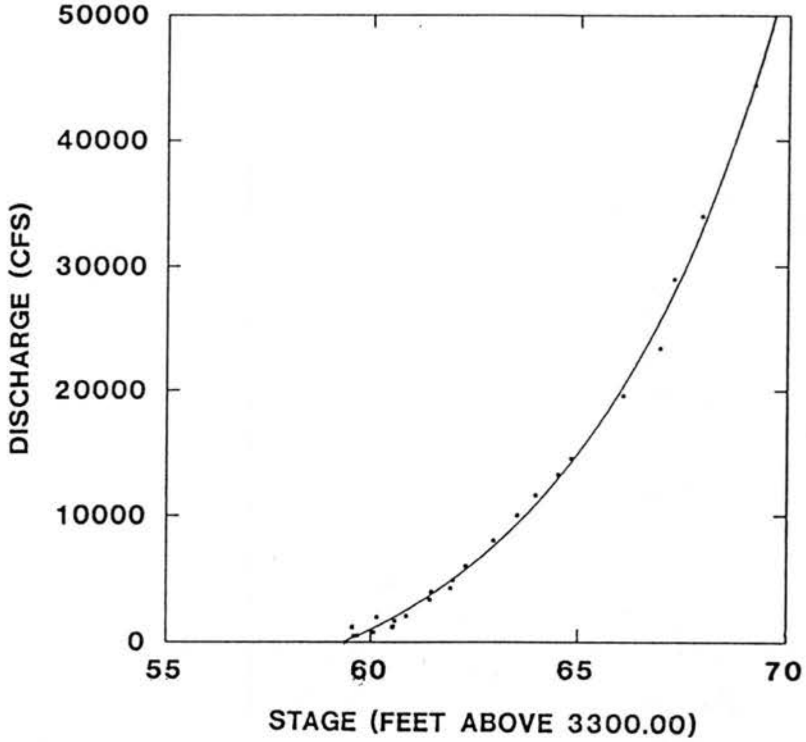


Figure 10. Stage-discharge relationship at riparian cross-section 1.

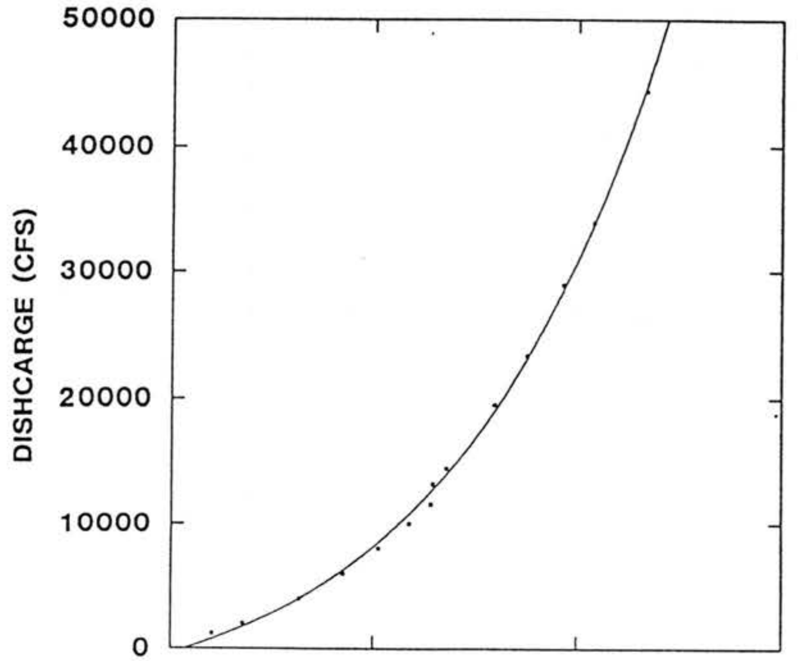


Figure 11. Stage-discharge relationship at riparian cross-section 2.

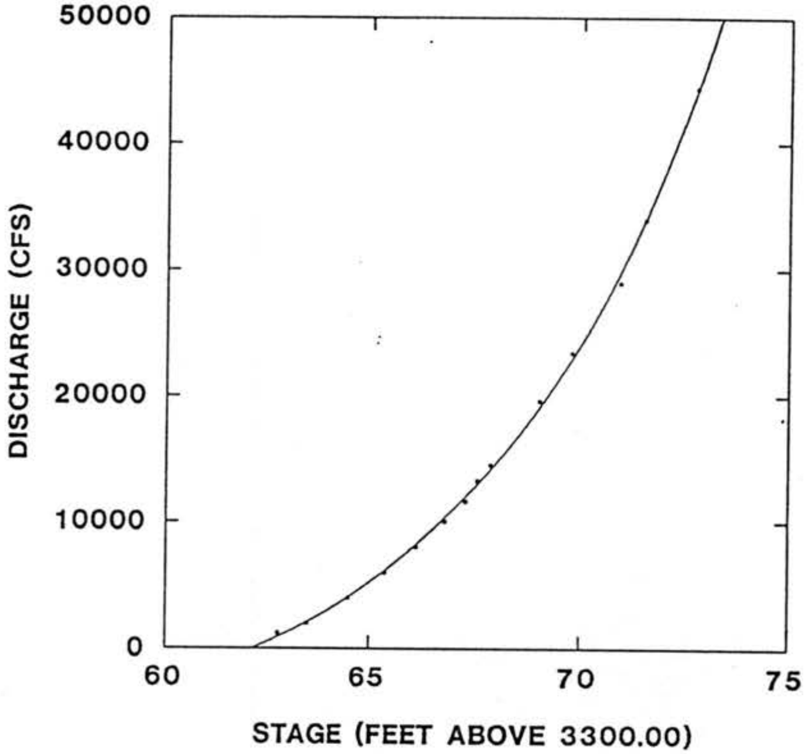


Figure 12. Stage-discharge relationship at riparian cross-section 3.

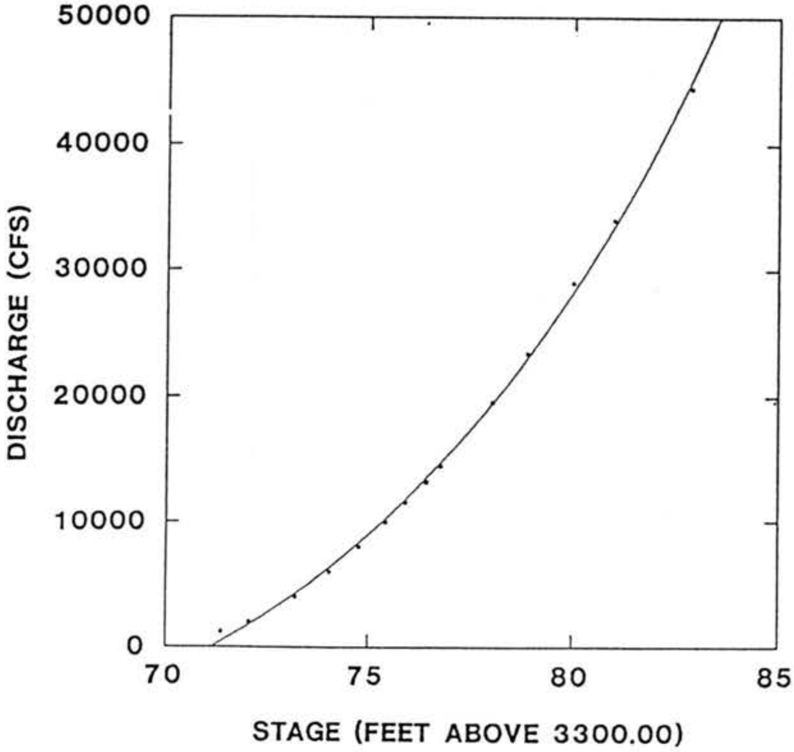


Figure 13. Stage-discharge relationship at riparian cross-section 4.

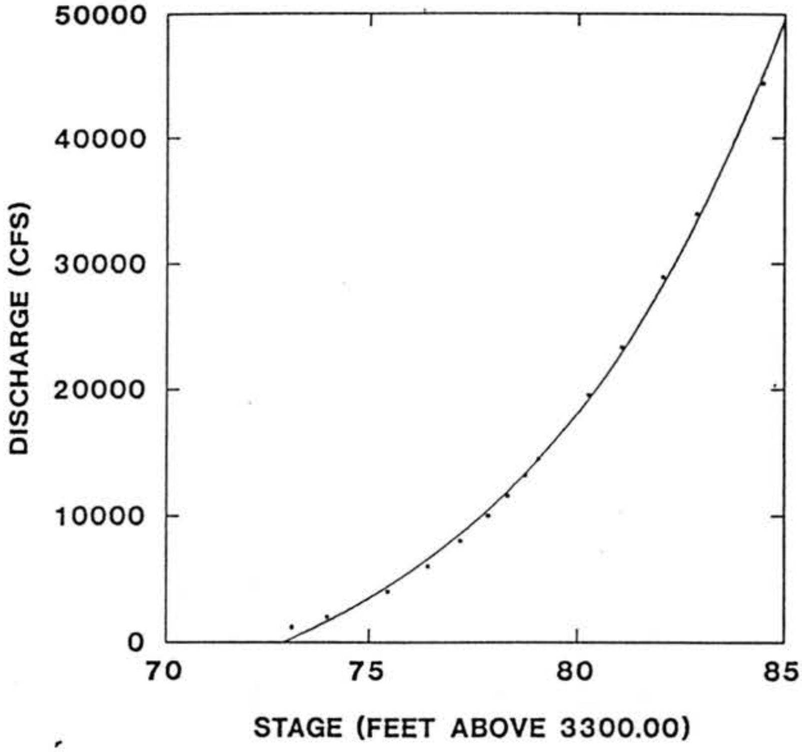


Figure 14. Stage-discharge relationship at riparian cross-section 5.

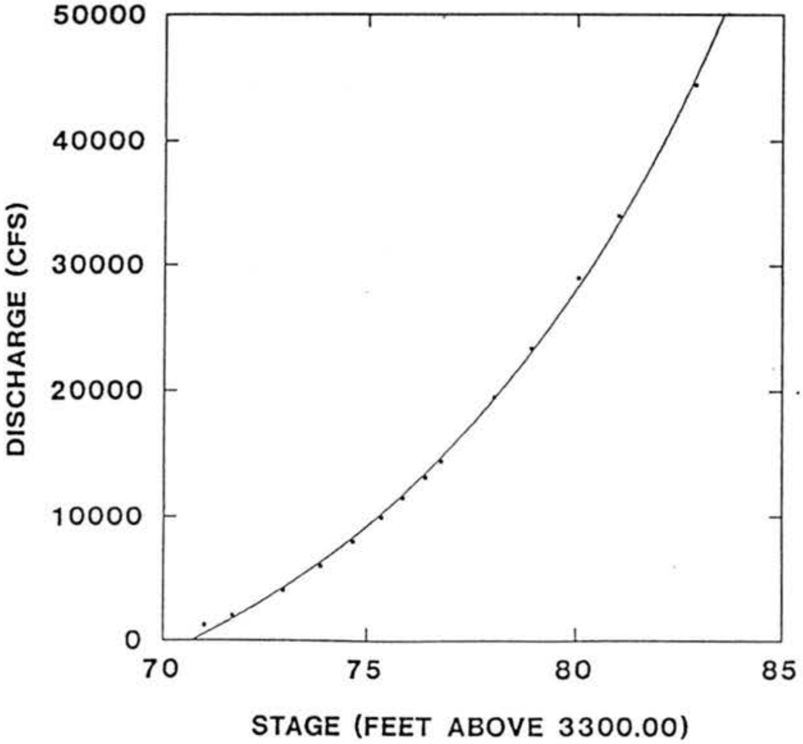


Figure 15. Stage-discharge relationship at riparian cross-section 6.

Table 14. Results of non-linear regression relating stage (ELEV) to discharge (Q) for the six riparian /HEC-2 transects along the Middle Fork Flathead River, Montana: Nyack Flats study reach.

Riparian Transect	Stage:Discharge Equation	Raw R2	Corrected R2	Source	Sum-of-squares	df	Mean-square
1	Q=0.03*e(0.21*ELEV)-6696.34	0.998	0.996	Regression	5.68 E+9	3	1.89 E+9
				Residual	1.29 E+7	22	5.87 E+5
				Total	5.69 E+9	25	
				Corrected	3.35 E+9	24	
2	Q=0.04*e(0.20*ELEV)-5479.32	0.999	0.998	Regression	5.62 E+9	3	1.87 E+9
				Residual	3.28 E+6	11	2.98 E+5
				Total	5.63 E+9	14	
				Corrected	2.15 E+9	13	
3	Q=0.11*e(0.18*ELEV)-7711.85	0.999	0.999	Regression	5.62 E+9	3	1.87 E+9
				Residual	1.76 E+6	11	1.60 E+5
				Total	5.63 E+9	14	
				Corrected	2.15 E+9	13	
4	Q=5.54*e(0.11*ELEV)-16455.0	0.999	0.999	Regression	5.62 E+9	3	1.87 E+9
				Residual	2.63 E+6	11	2.40 E+5
				Total	5.63 E+9	14	
				Corrected	2.15 E+9	13	
5	Q=0.12*e(0.15*ELEV)-9058.95	0.999	0.998	Regression	5.62 E+9	3	1.87 E+9
				Residual	3.53 E+6	11	3.21 E+5
				Total	5.63 E+9	14	
				Corrected	2.15 E+9	13	

Table 14. Continued.

Riparian Transect	Stage:Discharge Equation	Raw R2	Corrected R2	Source	Sum-of-squares	df	Mean-square
6	Q=3.45*e(0.18*ELEV)-14134.3	0.999	0.999	Regression	5.62 E+9	3	1.89 E+9
				Residual	2.54 E+5	11	2.31 E+5
				Total	5.63 E+9	14	
				Corrected	2.15 E+9	13	

approximately equal, number of observations (i.e., plots) fell into each class. Table 15 shows the nine inundation classes, minimum inundating discharge, and estimated probabilities or recurrence intervals associated with each event. The end product of the hydrologic data analysis therefore, was a set of hydrologic characteristics that described each plot in terms of a minimum inundating discharge and fraction of time inundated.

Table 15. Definition of the nine inundation classes representing a hydrologic gradient of inundation duration.

	Inundation Classes								
	1	2	3	4	5	6	7	8	9
% Time Inundated	>25	10-25	2-10	1-2	.45-1	.35-.45	.25-.35	.15-.25	<.15
Discharge (cfs)	215	1050	7625	11200	14900	19800	25000	36200	96000
Recurrence Interval Event	$<Q_1$	$<Q_1$	$<Q_1$	Q_1	Q_2	Q_5	Q_{10}	Q_{50}	$>Q_{100}$
Number of Plots	18	18	25	23	28	22	36	25	4

VEGETATION

Riparian plant species were classified according to their observed distributional patterns using TWo-way INdicator SPecies ANalysis - TWINSPAN (Hill 1979). TWINSPAN is a FORTRAN computer program that classifies or groups sample plots and species according to their ecological preferences. Species, or groups of species, with clear ecological preferences can be used to identify particular environmental conditions (Hill 1979). The purpose of using TWINSPAN was to aggregate 91 observed riparian plant species (see Appendix A for species list) and 198 sample plots into distinct cover types. This later simplified the process of identifying and characterizing changes in riparian plant distributions and patterns.

Through repeated hierarchial dichotomization, TWINSPAN constructs a two-way classification table that exhibits the relation between species and samples by grouping species with similar distributions together and stands with similar compositions together (Figure 16). Stands or plots are first ordinated (referred to as the primary ordination) along a pattern or direction of variation in the data using the method of reciprocal averaging (Hill 1979). The process of reciprocal averaging initially assigns arbitrary values to individual species according to their ecological preferences. Stand scores are then determined by taking averages of the scores of the species which occur within them. New species scores are then calculated from the new stand scores, and so on, until the scores stabilize.

After stands are arranged along the primary ordination, it is divided at its middle to produce a crude, or unrefined, dichotomy. Differential species that have a preference for either the left or right side of this primary dichotomy are then identified. A differential species is one with clear ecological preferences, whose presence often indicates a particular set of environmental conditions (Hill 1979). A second refined ordination is then made on the basis of these differential species. This refined ordination is used to determine or produce the desired dichotomy. TWINSPAN constructs a third and final ordination using a small number of the most strongly differential species. These highly preferential species and the final ordination are not used to actually determine the final dichotomy, but are provided as a convenience to the user as a succinct characterization of each division (Hill 1979).

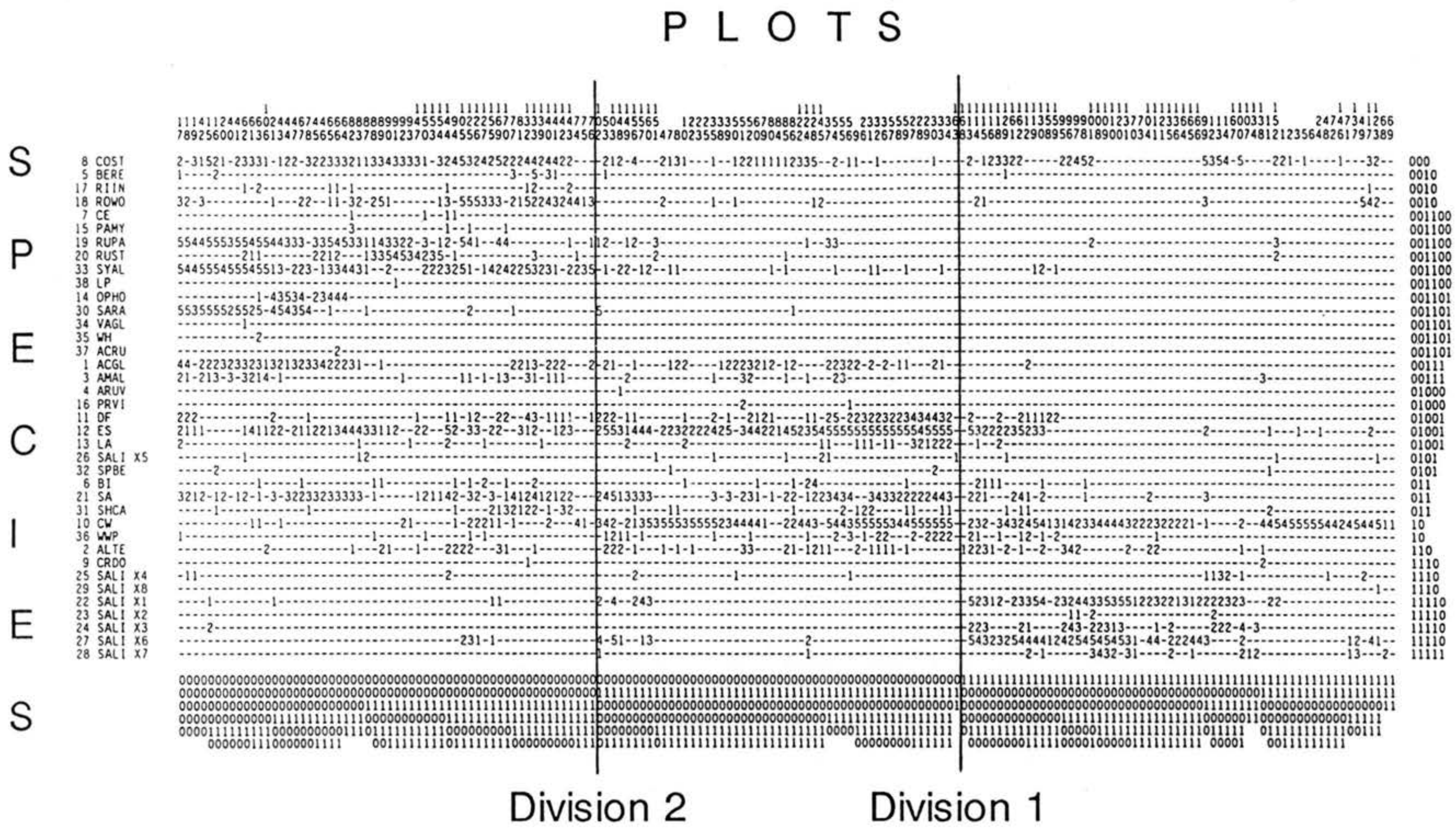


Figure 16. TWINSPAN constructed two-way classification table exhibiting the relation between species and samples. Species with similar distributions and stands with similar composition are grouped together.

The final product of the TWINSPAN analysis is an ordered, two-way site-by-species classification table which typically arrays species and stands in a diagonal structure (Figure 16). This diagonal structure often reflects an underlying environmental gradient. In short, TWINSPAN is an effective tool which allows the user to objectively identify natural groupings of similar plots and species, as they are distributed along a perceived environmental gradient.

TWINSPAN allows for up to 15 divisions in any particular run with the default value set equal to 6 for standard analyses. Hill (1979) states that there is seldom any value in dividing subgroups beyond a certain limit. TWINSPAN may make higher divisions based on the presence or absence of one particular species, however, this seldom provides additional insight into interpreting the ecological significance of a particular cover type or sample set (Auble et al. 1991). Consequently, the number of divisions was kept to a minimum (usually less than 6) so that each division produced floristically and spatially distinct cover types (after Auble et al. 1991).

Standard TWINSPAN analysis was conducted on all species and plots across the six vegetation transects. Standard analysis implies that all parameters were set to the default values as outlined in Hill (1979). The only exception was that a species must have occurred in more than 5 plots to be included in each analysis, and plots that contained no species (i.e., barren of vegetation or completely inundated at time of sampling) were excluded from the analysis. Separate analyses were conducted on: presence/absence values associated with all 91 species, density values for all shrub and tree species, and percent absolute cover values for all shrub and herbaceous species. TWINSPAN input, output, and site-by-species two-way classification tables for each run are listed in Appendix E.

Each run tended to separate or identify the four distinct cover types shown in Figure 17. Referring to the site-by-species tables in Appendix E, note that the main divisions for species are indicated by a horizontal line, and by a vertical line for the samples. After omitting those plots that were devoid of vegetation, the first division, in all runs, separated those plots which were dominated by willow from those in which willow was absent or virtually absent. The second division separated the remaining plots into two groups; those in which black cottonwood, leafy aster (Aster foliacious), white sweet-clover (Melilotus alba), and common dandelion (Taraxacum officinale) were abundant, versus those which were dominated by spruce, sub-alpine fir, common snowberry (Symphoricarpus albus), red raspberry (Rubus idaeus), Wood's rose (Rosa woodsii), black elderberry (Sambucus racemosa), devil's club (Oplopanax horridum) and false raspberry (Rubus parviflorus). The remainder of the species showed a preference for one of these four cover types with only horsetail (Equisetum spp.), red-osier dogwood, buffaloberry, thin-leaved alder, and Rocky Mountain maple common to both the cottonwood and spruce cover types. Further explanation of the TWINSPAN output is detailed in Appendix E. The final product of the TWINSPAN analysis therefore, was the identification of the four major cover types shown in Figure 17, with each plot classified as belonging to one of these four cover types. In addition, TWINSPAN identified a few key indicator species that showed a marked preference or affinity for each of these cover types. Consequently, the result of the vegetation data analysis was a set of vegetative characteristics describing each plot in terms of a dominant cover type and the presence of associated key indicator species.

Figure 18 summarizes the steps taken to analyze both the hydrologic data and the vegetation data. In short, the end product of the data

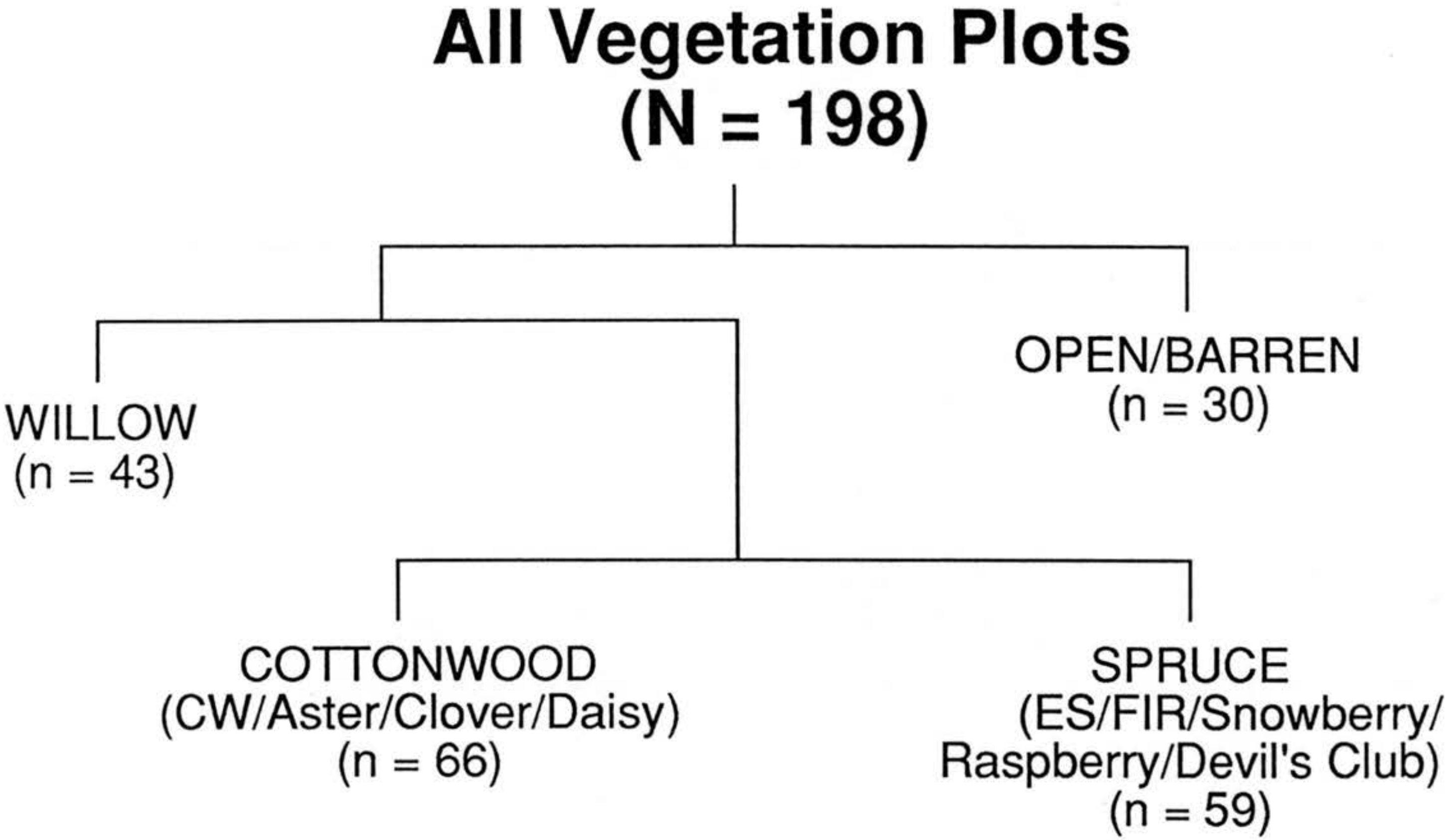


Figure 17. Schematic illustrating the divisions and distinct cover types identified by TWINSPAN.

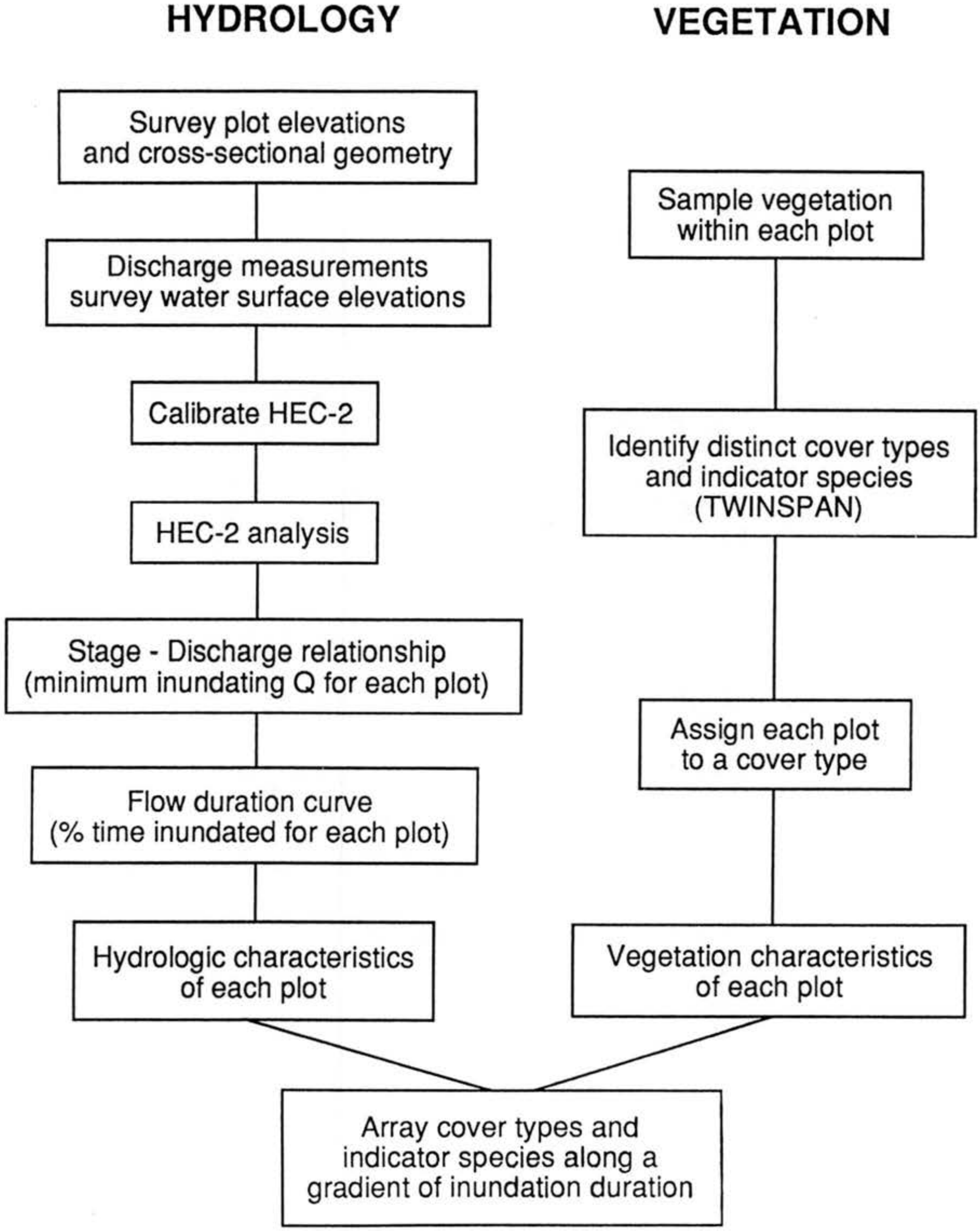


Figure 18. Simple flow chart summarizing data analysis procedures.

analysis was a set of hydrologic characteristics and a set of vegetative characteristics that described each plot in terms of a minimum inundating discharge, fraction of time inundated, dominant cover type, and the presence or absence of key indicator species. The final step related these two sets of characteristics in an attempt to describe and quantify the set of hydrologic conditions that supports the natural assemblage of vegetation within a given plot or cover type, along the Middle Fork of the Flathead River.

RESULTS AND DISCUSSION

Results

In this section, the hydrologic characteristics of each plot are related to the vegetative characteristics describing that plot. Recall that each plot fell into one of nine inundation classes (Table 15), and into one of four cover types (Figure 17). Therefore, within each inundation class, it was possible to census the total number of plots belonging to each of the four cover types. Table 16 and Figure 19 depict the distribution of the four cover types across the nine inundation classes. The proportion of plots in each inundation class is included, and can be interpreted as the probability that a plot belonging to a particular inundation class is classified as a particular cover type. For example, of the 22 plots that fell into inundation class 6, 13 were classified as cover type B (i.e., cottonwood), 8 were classified as cover type A (i.e., spruce), and the remaining plot was classified as cover type C (i.e., willow). Therefore, for those areas inundated .35-.45% of the time, there is roughly a 3/5 probability (i.e., 13/22 or 59% chance) that they can be expected to support vegetation similar to cover type B, and a 2/5 probability (i.e., 8/22 or 36% chance) that they support vegetation similar to a spruce cover type. Contrast this with inundation class 7, inundated .25-.35% of the time, where roughly 3/5 of the plots (i.e., 22/36 or 61%) were characterized as spruce cover type and the remaining 2/5 as cottonwood.

Viewed on the positive diagonal, Table 16 reflects a general trend in the distribution of riparian vegetation across a hydrologic gradient of

Table 16. Distribution of cover types across inundation classes (expressed as percent time inundated). Proportion of plots in each inundation class is given in parentheses.

	Inundation Class								
	1	2	3	4	5	6	7	8	9
Cover Type	>25%	10-25%	2-10%	1-2%	.45-1%	.35-.45%	.25-.35%	.15-.25%	<.15%
A (SPRUCE)	-	-	-	-	4 (0.14)	8 (0.36)	22 (0.61)	21 (0.88)	4 (1.0)
B (COTTONWOOD)	-	-	9 (0.36)	16 (0.70)	12 (0.43)	13 (0.59)	13 (0.36)	3 (0.12)	-
C (WILLOW)	4 (0.22)	7 (0.39)	14 (0.56)	5 (0.22)	11 (0.39)	1 (0.05)	1 (0.03)	1	-
D (OPEN)	14 (0.78)	11 (0.61)	2 (0.08)	2 (0.08)	1 (0.04)	-	-	-	-
Number of Plots	18	18	25	23	28	22	36	25	4
Discharge (cfs)	215	1050	7625	11200	14900	19800	25000	36200	96000
Recurrence Interval Event	$<Q_1$	$<Q_1$	$<Q_1$	Q_1	Q_2	Q_5	Q_{10}	Q_{50}	$>Q_{100}$

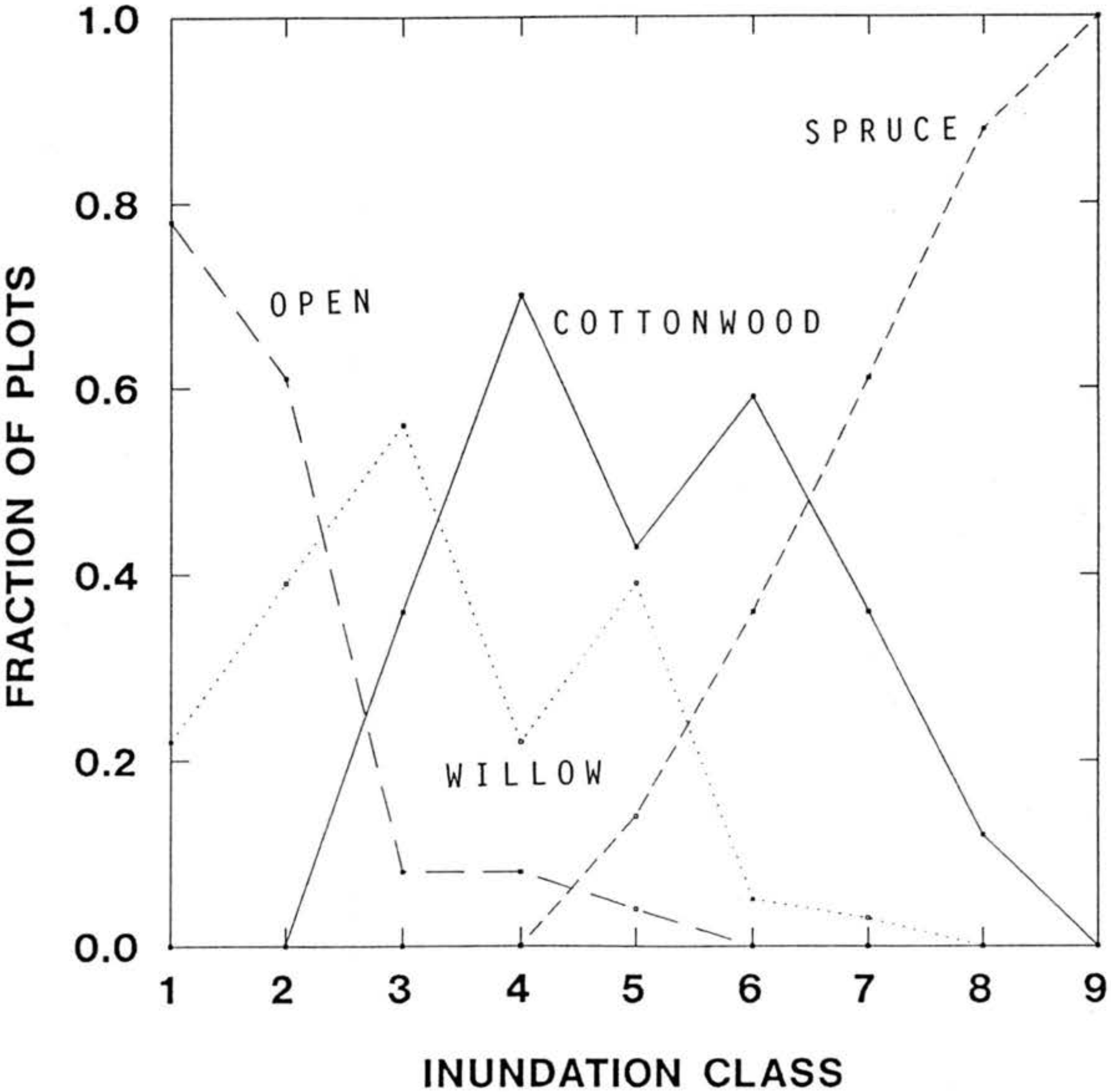


Figure 19. Distribution of cover types across inundation classes.

inundation duration. Note that with increasing distance from the channel and/or increasing elevation above the channel, there is a general transition from frequently flooded plots to less frequently flooded plots, or from wetter to drier conditions (i.e., from inundation class 1 to 9). Consequently, the vegetation communities range from barren, unvegetated plots to those dominated by willow or willow and cottonwood, to those dominated by cottonwood alone, and finally to those dominated by spruce, fir, and other upland species. This is usually quite obvious and easily supported by even casual observations of the riparian community along the Middle Fork of the Flathead River. However, by relating the distribution of cover types along a gradient of inundation duration, it was possible to quantify the hydrologic conditions (in terms of magnitude, frequency, and duration of discharge) that support each cover type.

Notice that in Table 16, most of the vegetation occurs in those plots that are inundated less than or equal to 1-2% of the time (i.e., inundation classes 4-9). This corresponds to a minimum inundating discharge of approximately 11000 to 12000 cfs. Discharges of this magnitude appear to correspond to the annual event and most likely represent bankfull discharge. The photographs in Figure 20 are typical of the Nyack Flats study site and illustrate the absence or scarcity of any and all vegetation within the active channel. What little vegetation that was found within this zone consisted primarily of an assortment of willow species and occasional grasses and forbs. However, willows were the only plant species consistently found in those areas inundated by discharges less than bankfull (Figure 21). These willow species are well adapted to intense physical battering, and prolonged inundation associated with the low magnitude, high frequency events common to this zone.

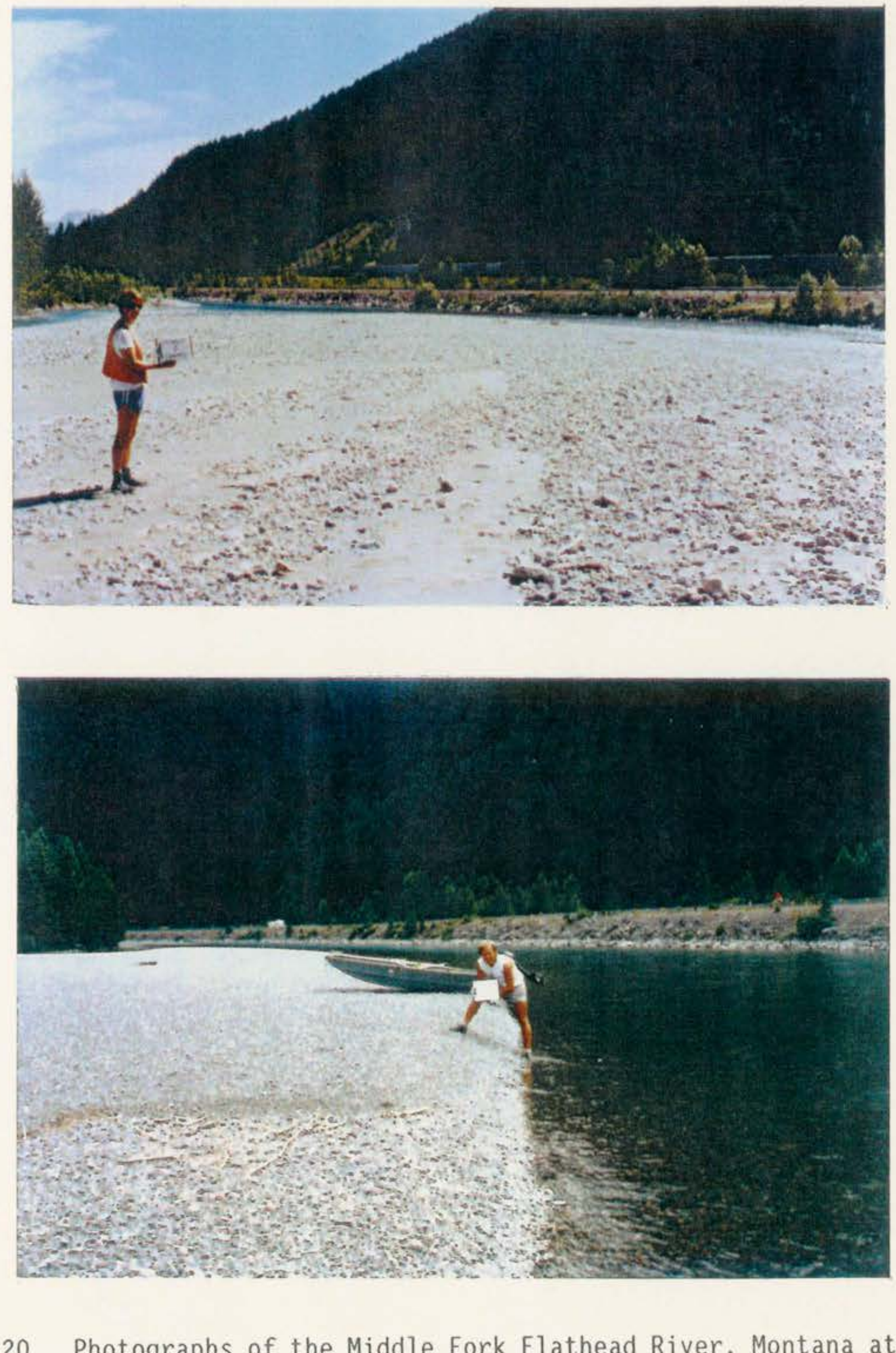


Figure 20. Photographs of the Middle Fork Flathead River, Montana at the Nyack Flats study site. Note complete absence of any and all vegetation within the active channel.

Figure 21. Typical plot within the willow community or cover type. (COVER TYPE = C).

Suitable sites for cottonwood and willow recruitment are usually moist and barren, consisting of newly deposited alluvium that is exposed to full sunlight (Hansen 1989, Smith 1957). In such a dynamic, unregulated system as the Middle Fork of the Flathead River, the conditions associated with the lower inundation classes (i.e., prolonged inundation, physical battering, high velocities and shear stresses, larger substrate, and lack of well developed soils) are usually less than optimum for willow germination and establishment, and even less so for cottonwood. The inherent variability in the magnitude and timing of annual peak flows further magnifies the problem. Consequently, cottonwood and willow species tend to be absent, or only slightly abundant, in the lower discharge classes, and first appear at the edge of the active channel.

Immediately above the active channel (i.e., inundation classes 4,5, and 6) the riparian community was dominated by stands of cottonwood or mixtures of cottonwood and willow. These sites are inundated by flows that exceed bankfull discharge, however, they are still flooded on a relatively frequent basis, usually at least once every 1 to 5 years (Table 16). These hydrologic characteristics often create favorable conditions necessary to recruit and sustain these species. As illustrated in Figure 22 many of the plots in these inundation classes were dominated by cottonwood with relatively little vegetation in the understory. Gradually, however, as elevation and distance from the active channel increased, there was a notable increase in understory grass, forb, and shrub species.

Those plant species associated with the spruce cover type began to appear on the edge of the cottonwood community, where they were often very abundant in the understory. Plots that were dominated by dense stands of cottonwood trees in the overstory, for example, often contained as many as

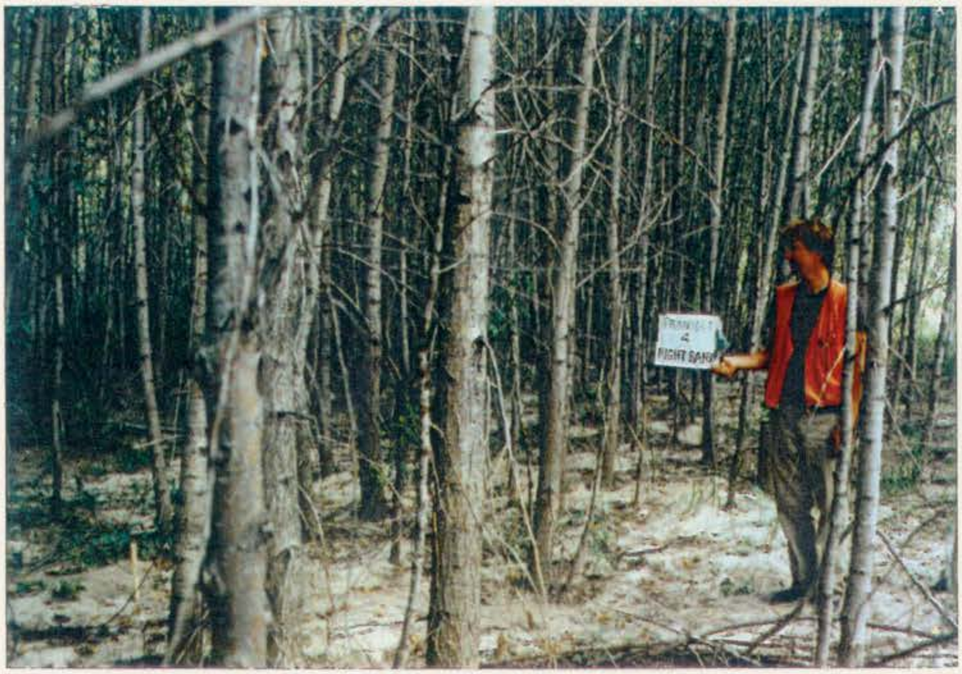


Figure 22. Typical plot in the cottonwood community or cover type. Note the relatively sparse understory and dense thicket of cottonwood seedlings and saplings. (COVER TYPE = B).

50-100 spruce seedlings in the understory. Typically these stands fell into the higher inundation classes (e.g., inundation classes 6 and 7), and in the absence of further disturbance (e.g., destructive flooding), these sites may eventually be dominated by spruce and/or subalpine fir and ultimately resemble the adjacent upland community.

For the most part, however, those plots which fell into inundation classes 7, 8, and 9 were almost exclusively characterized as a spruce cover type. Discharges associated with these inundation classes are usually 25000 cfs and larger, and represent recurrence intervals of 10 years or more. Obviously flows at this end of the spectrum are associated with rare, high magnitude events, and the vegetation found there is usually least adapted to hydrologic conditions associated with lower inundation classes. These areas are located high enough and far enough from the active channel that they are rarely, if ever, inundated. Consequently, vegetation in these higher inundation classes closely resembles that of the surrounding adjacent uplands.

In an attempt to further illustrate the distribution of riparian vegetation along a gradient of inundation duration, abundance parameters for some of the key indicator species, identified by TWINSPAN, were plotted against the same nine inundation classes. In Figures 23, 24, and 25 the average number of stems or plants per plot (i.e., density) for spruce, cottonwood, and willow, respectively, are plotted against inundation class. Note that the density of spruce trees (i.e, seedlings and saplings) was highest in the higher inundation classes, with inundation class 7 exhibiting the highest density, with more than 20 stems per plot. As noted earlier, the high density of spruce trees in inundation classes 4, 5, and 6 can be explained by the large number of spruce seedlings found in the understory of those plots dominated by

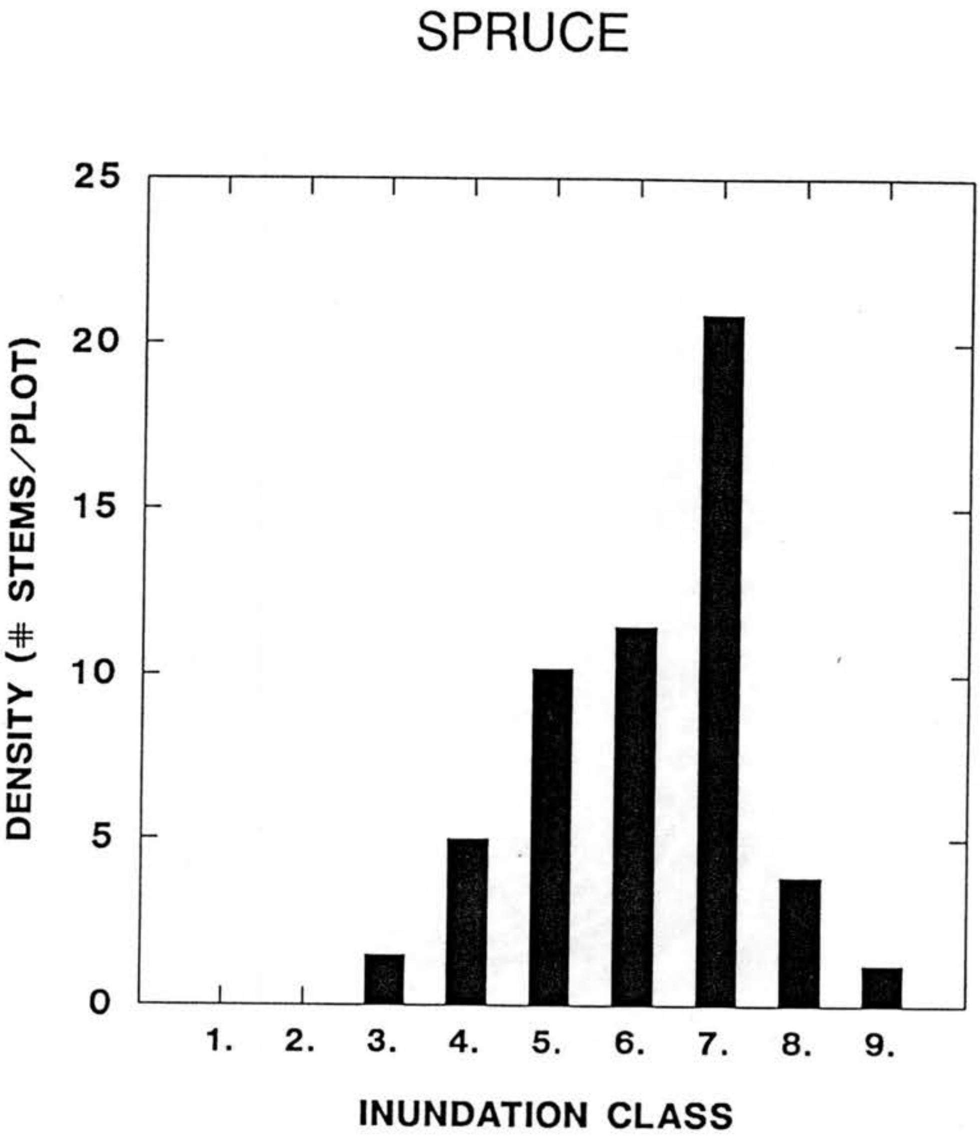


Figure 23. Distribution of the average number of spruce (<u>Picea engelmannii</u> x <u>glauca</u>) stems (i.e., density) across inundation classes.

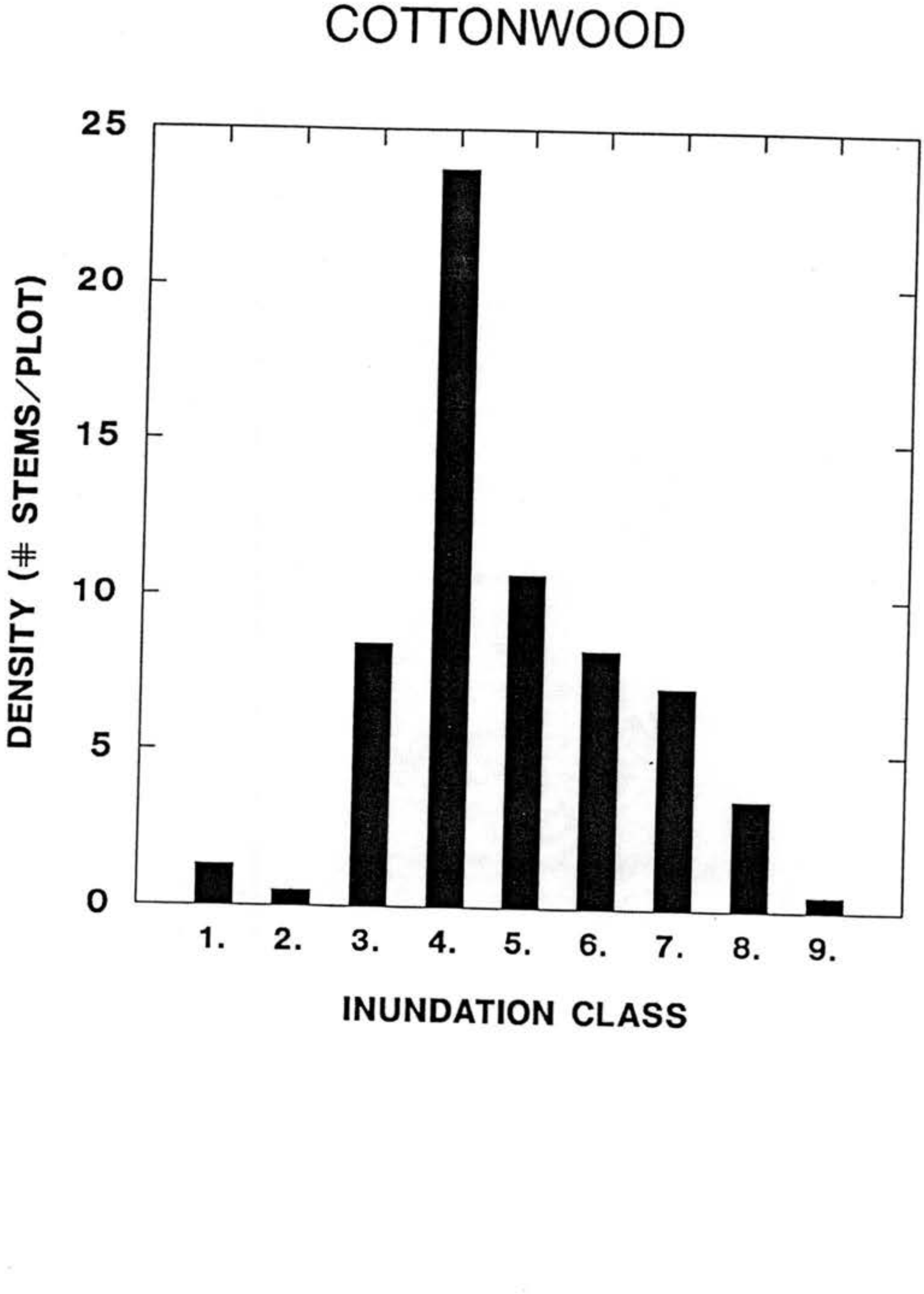


Figure 24. Distribution of the average number of cottonwood (Populus trichocarpa) stems (i.e., density) across inundation classes.

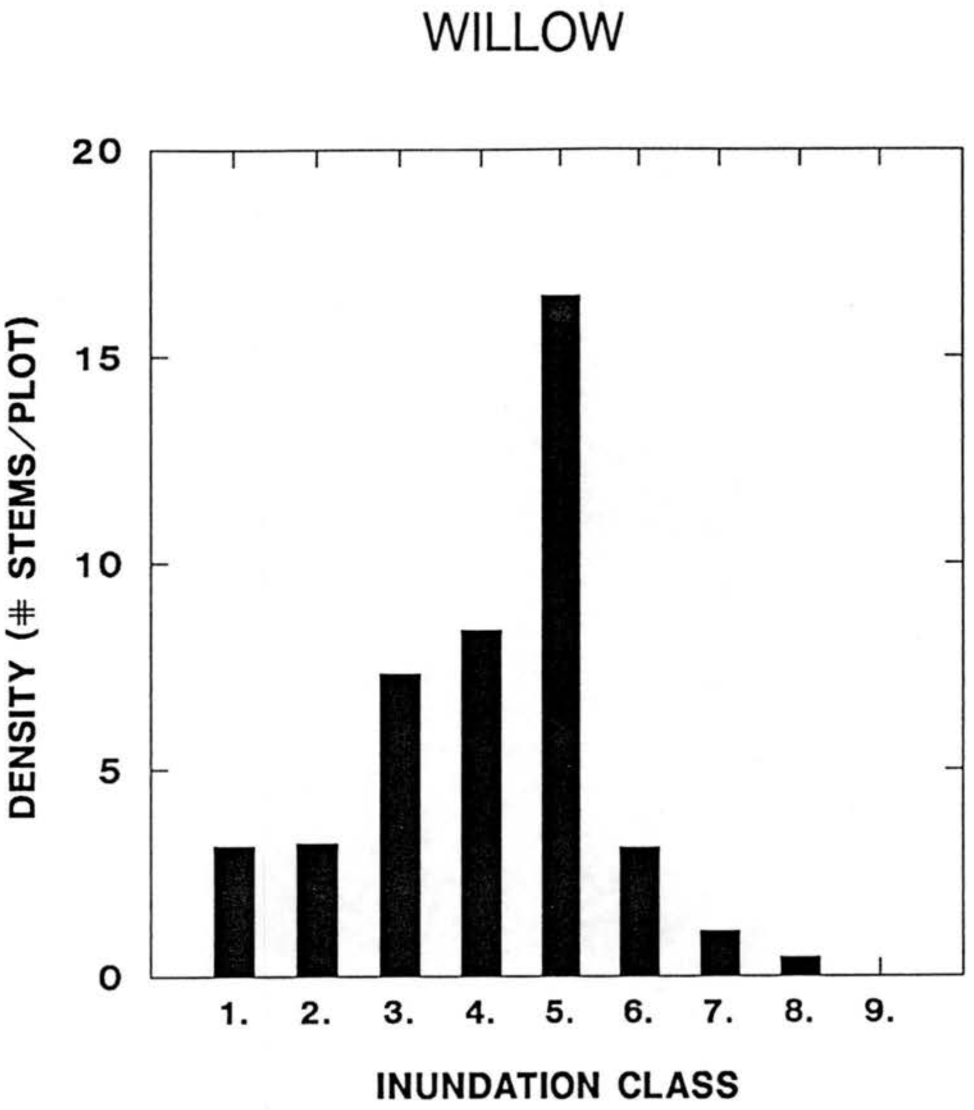


Figure 25. Distribution of the average number of willow (Salix spp.) plants across inundation classes.

cottonwood. Even though the density of spruce trees is relatively low in inundation classes 8 and 9, relative to inundation classes 5, 6, and 7, most of these plots were typical of mature upland communities characterized by a small number of relatively large, old spruce and subalpine-fir trees. These plots were characteristically dominated by a relatively closed canopy with a dense shrub understory and herbaceous layer (Figure 26).

Cottonwood densities were greatest in inundation class 4, averaging more than 23 stems per plot, more than twice the density of any of the other inundation classes (Figure 24). Obviously, cottonwood was most abundant in the middle inundation classes, and essentially absent in the lowest and highest inundation classes. The few cottonwood individuals that were present in the highest inundation classes were very large (e.g., diameters at breast height in excess of 40 inches, and heights greater than 70 feet), old (at least 100 years) individuals scattered throughout the remnant floodplain (Figure 27). Cottonwoods found in the lowest inundation classes were small (less than 1 inch in diameter and less than 3 feet tall), young (less than 1-2 years old) individuals growing on the edge of the active channel either alone or in and among stands of willow. The majority of the cottonwoods, however, (i.e., highest densities) showed a marked preference for the middle inundation classes.

The distribution of willow density across the inundation classes (Figure 25) proved a bit confusing at first, with the highest density occurring in inundation class 5. This seemed contrary to what was actually observed in the field, and contrary to the results presented in Figure 19 and Table 16, which indicated that willow were most abundant in the lowest inundation classes. Figure 28 compares the average percent absolute cover (i.e., average percentage of each plot covered by willow)

Figure 26. Typical plot in a spruce community or cover type. (COVER TYPE = A).

Figure 27. Remnant floodplain dominated by upland vegetation (e.g., spruce and fir), with an occasional large, old mature cottonwood tree. Large cottonwood is in the foreground, left of center.

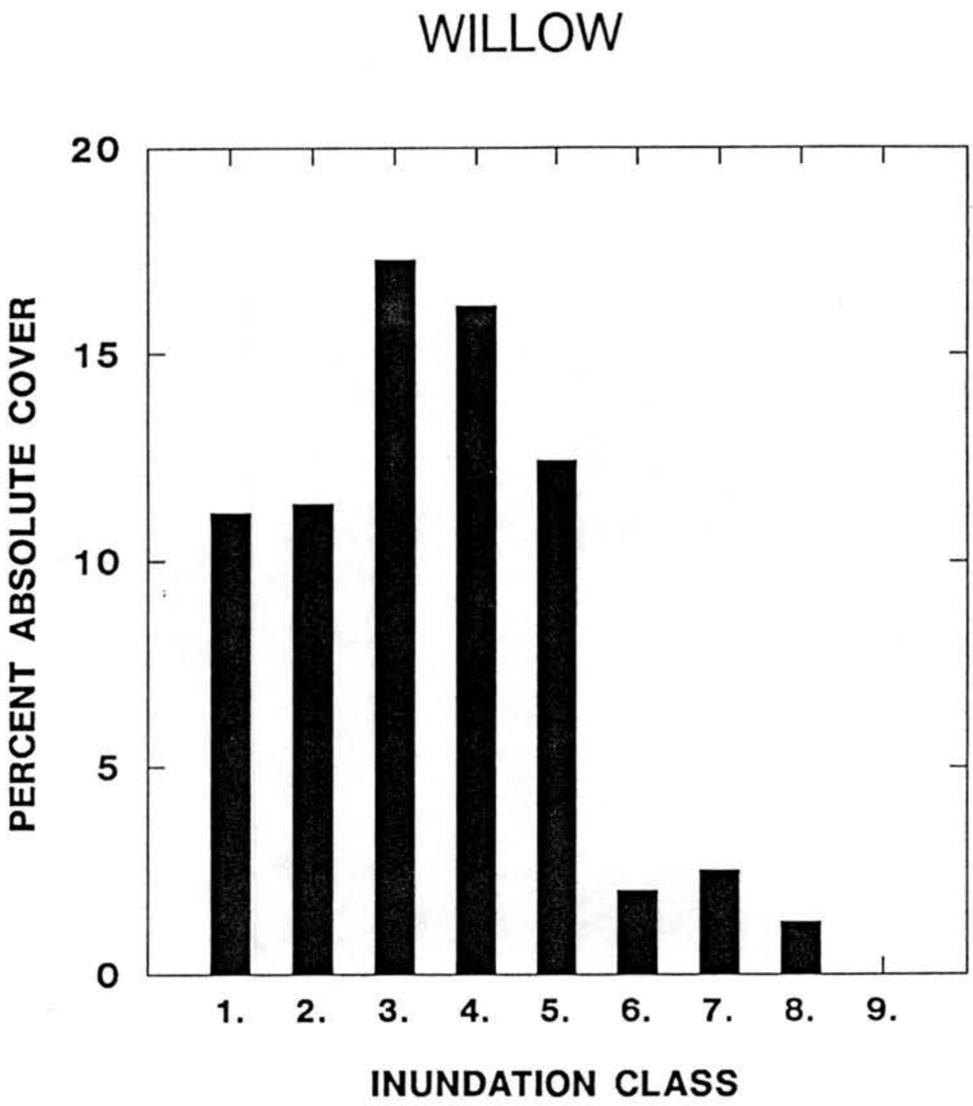


Figure 28. Distribution of average percent absolute cover of all willow species (i.e., proportion of each plot covered by willow species) against inundation class.

for all willow species against inundation class. Rather than the number of stems per plot (i.e., density), percent absolute cover more accurately portrays the dominance of most shrub species. Willows, like most shrubs, tend to be multi-stemmed. And this, coupled with the fact that they are often subject to repeated scour and burial often makes it difficult to count the actual number of individual plants or stems. Percent absolute cover yielded more reliable estimates of willow dominance in each plot. For example, a given plot could have contained 20 willow plants or bushes which covered only 5% of the plot, whereas another plot may have had only 3 plants, yet they covered as much as 50% of the plot. Obviously, in cases such as this, percent absolute cover would more accurately predict willow dominance than would the number of stems per plot (i.e., density). This was not a significant problem with respect to the tree species encountered since most of them tended to be very uniform in size and shape. Therefore, 50 stems of a given tree species in one plot covered about the same area as 50 stems of the same species in another plot.

Figure 28 accurately represents field observations regarding willow dominance across an elevational or hydrologic gradient. Furthermore, the distribution of willow, as seen in Figure 28, is consistent with the results presented in Figure 19 and Table 16. For the reasons outlined earlier, and as evidenced in Figure 28, willow species showed a marked preference for the lower inundation classes, being most abundant, or dominant in inundation class 3. Note, however, that willow were also relatively abundant in inundation classes 1 through 5, reflecting their tolerance for a wide range of hydrologic conditions. Willows were the only species that exhibited any real degree of tolerance for the harsh growing conditions often associated with inundation classes 1 and 2.

Figures 29 and 30, summarize the distributions of these three species across the nine inundation classes. Figure 29 is simply a plot of density versus inundation class for all three species, whereas Figure 30 plots density of cottonwoods and spruce and percent absolute cover of willow, across the nine inundation classes.

Discussion

Thus far, the presentation of results has been in terms of distinct cover types and key indicator species. Note that a similar type of analysis could be done for any one of the observed riparian species, and for any number of measured abundance parameters. With spruce, for example, the analysis could have been extended to illustrate the distribution of diameter classes, height classes, or basal area per plot, across the nine inundation classes. Similarly, any one of the forb or grass species could have been selected and its presence/absence and abundance plotted against the nine inundation classes to determine the ideal set of hydrologic conditions required to support that particular species. In most instances, the results of those types of analyses would reflect what was often observed in the field. Average basal area per plot of spruce, for example, would be expected to be highest in the higher inundation classes (i.e., those dominated with large, mature overstories of spruce and subalpine fir). Likewise, many of the species common to a particular cover type could be expected to "behave" similarly as that cover type.

Realize that the objective of this study was not to explain or describe each species' individual position along the hydrologic gradient, but rather to determine how natural streamflows affect and dictate the composition, areal extent and occurrence of riparian vegetation along the

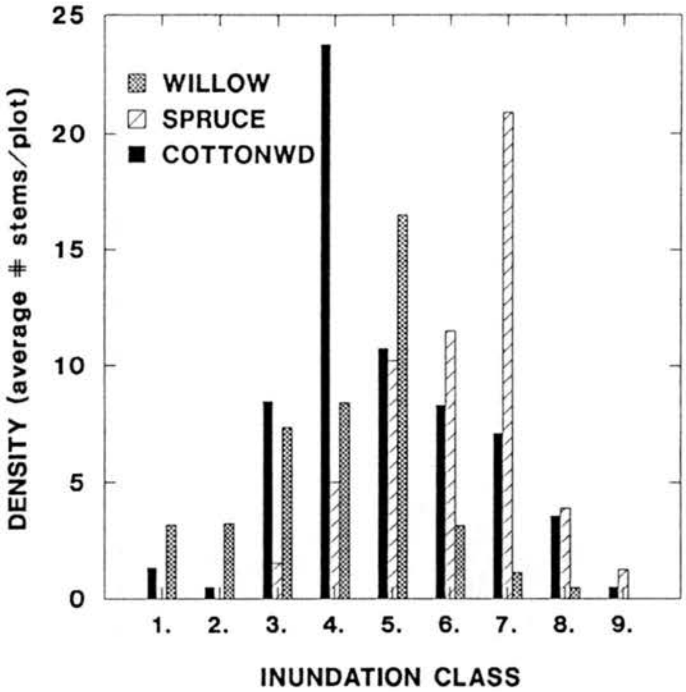


Figure 29. Distribution of spruce, cottonwood, and willow density across inundation classes.

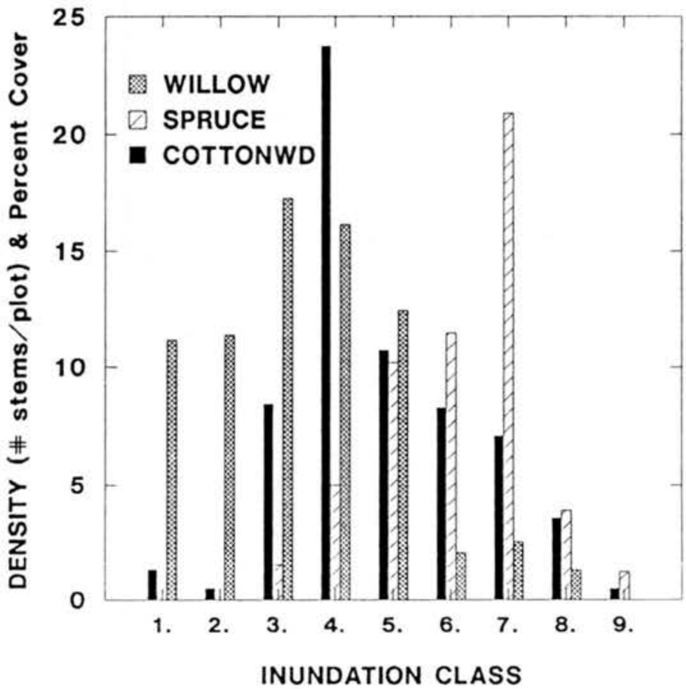


Figure 30. Distribution of spruce and cottonwood density, and willow percent absolute cover across inundation classes.

Middle Fork of the Flathead River, and to quantify the hydrologic conditions required to support this natural assemblage of vegetation. Therefore, it is beyond the scope of this study to specifically outline the set of hydrologic conditions necessary to support each of the 91 observed riparian species, and hence the advantages of using TWINSPAN should be readily apparent.

The distinct cover types identified through the TWINSPAN analysis are the basic units of vegetation change and description. These basic cover types are usually of greatest interest to land managers, resource consultants and environmental engineers. Any anthropogenic disturbance which results in changes or shifts in the distribution, occurrence, or areal extent of these cover types is often viewed as a significant impact to the riparian community. Consequently, it is often desirable to quantify the set of hydrologic conditions which support the various cover types encountered along a riparian corridor. However, demonstrating how any single species is individually distributed along the same hydrologic gradient of inundation duration also provides managers with vital information. This knowledge would be especially useful if the intent or goal of the study was to understand the distribution of selected indicator species vital to a particular wildlife species, or if the plant specie or species themselves were considered rare, threatened, or endangered, and therefore of special interest or concern.

For the most part, however, the response of cover types to changing hydrologic conditions are usually of greatest concern and interest. Note that there is often overlap with respect to the hydrologic conditions describing any particular cover type. Usually, species are adapted to a range of environmental and hydrologic conditions, and sharp delineations between cover types are no more apparent or realistic than sharp delineations between zones of varying flood severity or intensity. Each species is uniquely adapted to, and tolerant of, a range of environmental, including hydrologic, conditions. Consequently, species tend to be arrayed along these gradients of environmental factors according to their response or tolerance of a particular complex of environmental conditions. As a result, several of the plots in one cover type, may have contained species more common to an adjacent cover type, and therefore, exhibit a transition potential for that cover type. This potential may or may not be realized depending on the time interval between extreme disturbance events (e.g., catastrophic floods). It is often contested whether riparian communities are merely plant communities in various stages of recovery since the last destructive flood; or that riparian communities are maintained by periodic flooding (i.e., by frequent and prolonged inundation and susceptibility of plants to destructive flooding) and that succession after flooding has little to do with vegetation patterns on fluvial landforms. Regardless, both schools of thought would support the idea that as the time interval since the last major event increases, there is a greater likelihood that a given plot may eventually exhibit a species composition and structure similar to latter seral stages, in this case, a general trend toward a more upland type community.

Further realize that the current position of a plot may place it in one inundation class, but other factors may dictate its species composition (e.g., light availability, shade tolerance, geomorphic surface, nutrient availability). An underlying assumption of this analysis was that the hydrologic gradient of inundation duration is the aggregate variable which integrates a complex suite of environmental conditions, and therefore is the overriding factor influencing and dictating species distributions. That is, the fraction of time inundated is a relative, or surrogate, measure of all other environmental conditions affecting riparian plant distributions (after Auble et al. 1991). Thus factors like shear stress, depth to groundwater, sediment deposition and erosion, soil moisture, and soil development and fertility at a given site are all related to the fraction of time that the site is inundated. For example, low elevation plots close to the channel are frequently inundated and also tend to be closer to groundwater, subject to greater shear stress, more frequent scour and/or deposition, and characterized by much less developed, less fertile, and coarser textured substrate or soils than higher elevation sites that are flooded much less frequently.

Given that the above assumption holds, it should then be readily apparent that any shift or change in the natural streamflow regime would result in a concomitant change in the adjacent riparian community. Upstream diversions or impoundments, for example, that significantly alter the natural hydrologic regime will produce a different flow duration curve resulting in a different fraction of time that each plot is inundated. Each plot therefore, is subject to a new set of hydrologic characteristics, which with time would support a different assemblage of vegetation. Figure 31 illustrates the type of shifts or changes in the distribution or location of riparian vegetation as a result of an altered streamflow regime. Under a scenario of drier hydrologic conditions (e.g., upstream diversion), a channelward movement or encroachment of riparian, and hence upland, vegetation would be expected. Water table-imposed limits to upland vegetation encroachment, however, may limit the degree or extent of this channelward migration. Under a drier flow regime, sites that previously were frequently flooded are flooded much less frequently. For example, those plots dominated by cottonwood that were previously inundated only once every 1 to 5 years, may now be flooded only once every

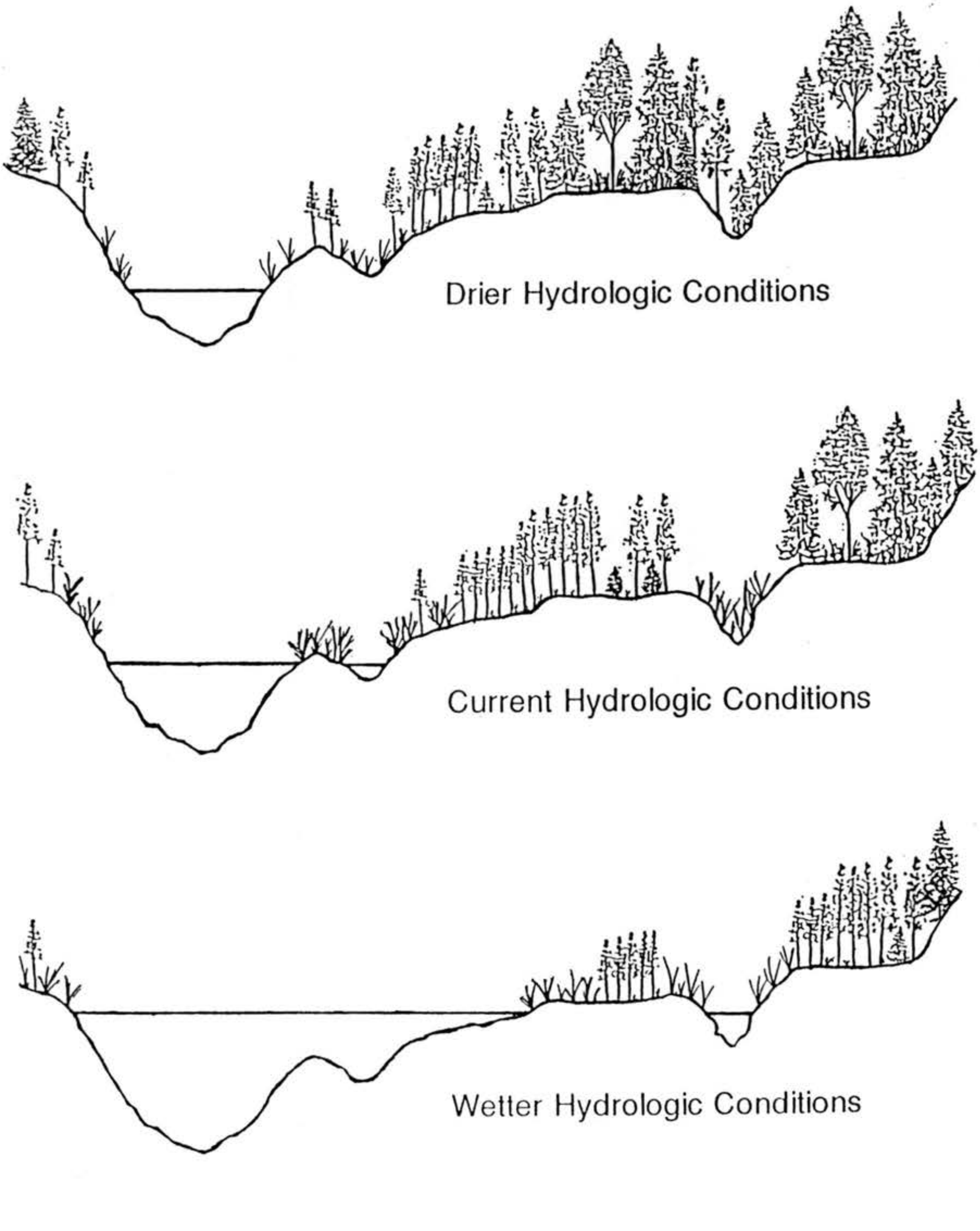


Figure 31. Diagram illustrating shifts in the distribution and location of cover types in response to changing flow regime.

5 to 10 years, or 10-25 years. Consequently, these plots may begin to realize their transition potential which previously was being held in check by frequent flooding. These plots may eventually be dominated by a more upland community characterized by spruce and/or subalpine fir and associated species. Similarly, under a scenario that produces wetter hydrologic conditions, there would be a general shift of the riparian vegetation away form the previous channel. Plots that were once dominated by willow and cottonwood may now be kept free of vegetation due to increased intensity, frequency, and duration of high flows. Likewise, many of the plots that once supported upland vegetation would eventually be dominated by more true "riparian" species (e.g., willow and cottonwood) that are better adapted to the new set of hydrologic conditions.

A second, and perhaps even more critical, assumption of this study was that the geometry of the hydraulic cross-sections remained stable throughout any flood sequence. That is, the geomorphic surface was assumed to remain unchanged with varying discharge. Consequently the minimum discharge required to inundate each plot remained constant across different hydrologic regimes. Usually, however, large sediment discharges into a river system cause an immediate increase in sediment to water ratios which result in attempts by the fluvial system adjust to the altered conditions (Schumm 1977). Responses by a fluvial system to increased sediment load often include channel pattern changes, changes in gradient, and localized zones of deposition, aggradation, and/or incision. These changes in turn influence the hydrologic position of any given point within the channel profile, thereby altering frequency, intensity, and duration of subsequent flooding. This process is further compounded by changes in the groundwater system, groundwater flow directions, channel water losses, and rising or falling groundwater levels (Bullard and Wells 1991), which also significantly affect riparian vegetation communities.

Cursory review of historical aerial photographs indicated significant lateral migration of the river channel through the Nyack study reach. The most significant changes in channel planform occurred throughout the broad alluvial zone known as Nyack Flats (Figure 4) following a major catastrophic flood in 1964. Maximum discharge at the USGS gaging station at Essex was estimated at 75300 cfs or roughly 3.9 times the 50-year flood and 4 times the maximum discharge during the previous 25 years of record (Boner and Stermitz 1967). This corresponds to a discharge of more than 102000 cfs at the Nyack Flats study site (Table 6). Obviously, infrequent discharges of this magnitude, coupled with the cumulative effects of the smaller more frequent floods, are the primary agents responsible for transporting sediment, and creating, modifying or shaping the alluvial landforms common throughout the Middle Fork of the Flathead River.

Clearly therefore, channel dynamics (i.e., fluvial geomorphology) play an important role in the environment of riparian plants. Typically, there exists a system of positive feedbacks between riparian vegetation, stream hydrology, and sediment transport (Figure 32). Channel and sediment dynamics associated with spring floods expose and/or deposit sediment and substrate often in the form of point bars and in-stream or mid-channel bars. These newly created alluvial surfaces often provide suitable sites for the establishment and development of riparian plant communities. In turn, the newly established vegetation stabilizes and binds these surfaces and enhances deposition of fine sediment during subsequent floods. With time, the accumulation of additional sediment increases the size and height of these geomorphic surfaces subjecting them to a new set of hydrologic conditions. These surfaces in turn, support a new assemblage of riparian vegetation that is better adapted to the new set of hydrologic conditions. Malanson and Butler (1990) found that the presence of woody debris further magnifies this process; stating that

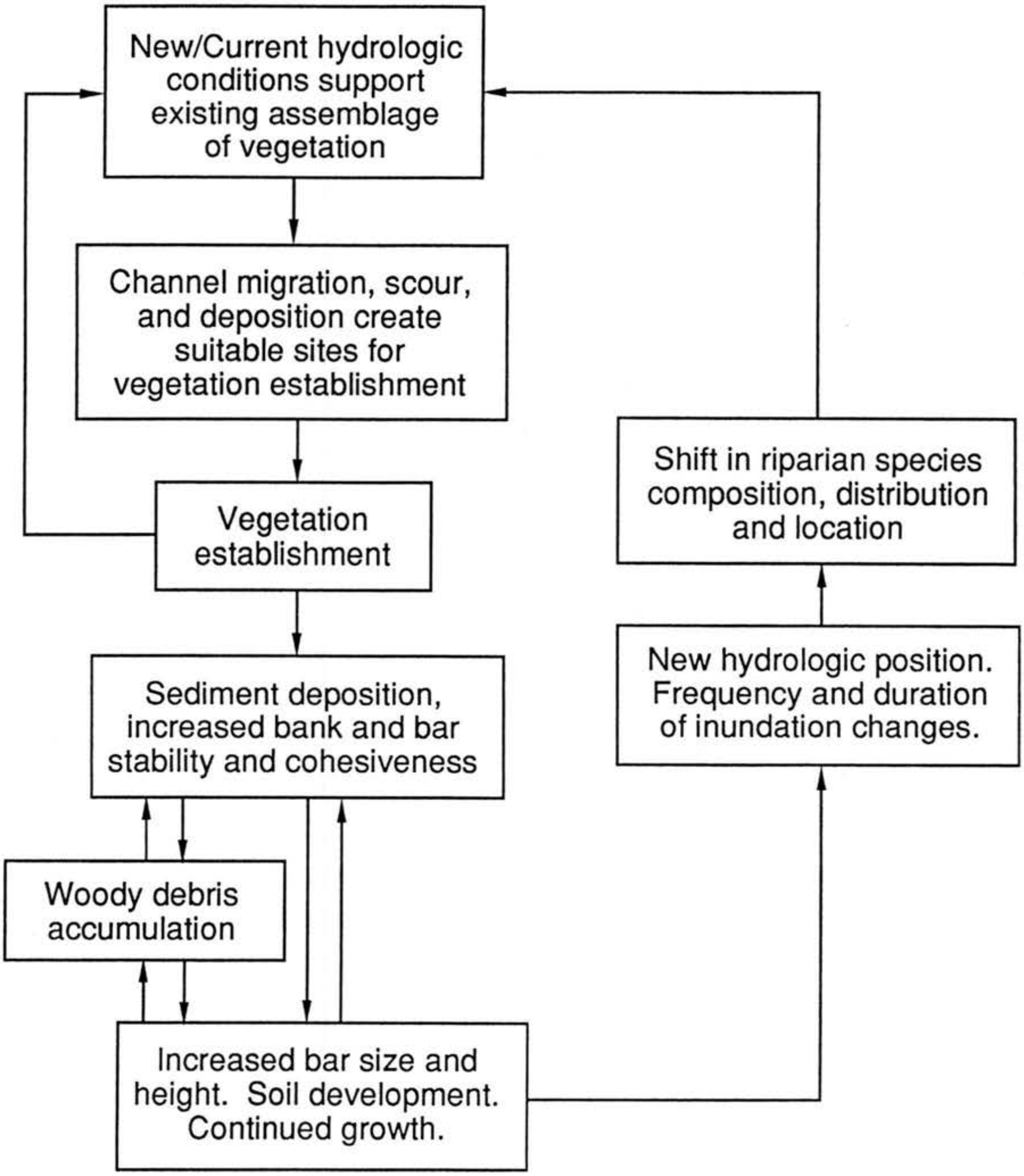


Figure 32. Conceptual model of the relationships between riparian vegetation, stream hydrology and sediment dynamics in alluvial bed rivers like the Middle Fork Flathead River, Montana.

plant species diversity is related to the area, sediment, and woody debris of bars. Eventually, or at any point in this process, a flow of sufficient magnitude and power can alter or scour these alluvial surfaces and the process starts anew. Consequently, species composition and distribution on these surfaces is constantly changing in response to changing hydrologic conditions, and sediment and channel dynamics.

In addition to the major assumptions cited above, there are also many shortcomings or limitations of this type of analysis. The conclusions and findings of this study are based solely on the response of observed riparian distribution patterns to a single hydrologic variable (i.e., fraction of time inundated), at a single point in time. Realize that there is a large variety of hydrologic variables that could have been used (e.g., fraction of time inundated during the seed dispersal and germination window), as well as a large number of various environmental gradients against which specie(s) and cover type distributions could have been arrayed (e.g., depth to groundwater, soil anoxia, substrate size, stream velocity, and shear stress). Further note that this analysis only captured the existing distribution of riparian vegetation at one moment in time, and thus provided insight into only a small fraction of the true range or continuum of species composition and vegetation response to past, and ever-changing, hydrologic and fluvial geomorphic conditions.

Obviously, herein lies the potential for future research. Namely, describing riparian vegetation distributions in response to a variety of hydrologic variables; the impacts of channel change, erosion, deposition, and scour on species distribution; and linking large-scale changes in riparian vegetation to hydrologic variables via a retrospective or historical analysis of aerial photographs.

SUMMARY AND CONCLUSIONS

Summary

Plant ecologist have long known and recognized the relationship between streamside vegetation and river hydrology. The distribution of riparian vegetation on riverine floodplains is dictated, in part, by species' response to flood disturbance. This vegetation depends not only on some minimum flow, but also, and perhaps even more importantly, on the existence of regular high flows. The goal of this study was to identify riparian vegetation distribution patterns that occur as a result of the natural streamflow regime of the Middle Fork of the Flathead River. More specifically, the objectives were to determine how natural streamflows affect and dictate the composition, areal extent, and occurrence of riparian vegetation along the Middle Fork of the Flathead River, and to quantify the hydrologic conditions required to support this natural assemblage of vegetation. This information will be used by the National Park Service to describe potential changes in riparian vegetation patterns due to hypothetical changes in the natural flow regime of the Middle Fork of the Flathead River within Glacier National Park, Montana.

To understand and relate riparian vegetation to streamflow, the existing pattern or distribution of riparian vegetation along the Middle Fork of the Flathead River was arrayed along gradients of flood intensity, magnitude, and duration. Vegetation patterns were determined from species abundance as observed in riparian transects centered over hydraulic cross-sections. A hydraulic model was calibrated and used to predict water surface elevations associated with different discharges for each plot along these transects. Subsequent hydrologic analysis described each plot in terms of the minimum discharge required to inundate the plot, and fraction of time it was inundated. TWINSPAN analysis of the vegetation data identified four dominant cover types and each plot was assigned to one of these four cover types. Plots (represented as cover types) were then arrayed across a hydrologic gradient (represented as a set of inundation classes) to determine the probability that a plot in a specific inundation class belonged to a particular cover type.

In terms of the magnitude, frequency, and duration of discharge of the Middle Fork of the Flathead River, a set of hydrologic characteristics necessary to support and sustain the four distinct cover types and key indicator species were identified and quantified. Table 17 summarizes the hydrologic conditions characteristic of the four distinct cover types found along the Middle Fork of the Flathead River.

Table 17. Summary of hydrologic conditions characteristic of each cover type.

Cover Type	Inundating Discharge (cfs)	Recurrence Interval (years)	Fraction of Time Inundated (%)	Inundation Class
A	25,000+	$>Q_{10}$	<0.35	7,8,9
B	10-25,000	$Q_1 - Q_{10}$	0.25 - 2	4,5,6,7
C	1-15,000	$<Q_1 - Q_2$	0.45 - 25	2,3,4,5
D	>250	$<Q_1$	>10	1,2

This information can be used to predict or assess how changes in the natural streamflow regime (as a result of diversions and impoundments) can be expected to influence the future distribution of riparian vegetation. This methodology has many obvious applications, and may be extremely useful to engineers and land managers when trying to assess the impacts of proposed water resource developments on the riparian community. It is beyond the scope of this study, however, to predict or identify the amount of water that could be impounded or diverted upstream on the Middle Fork of the Flathead without significantly altering the riparian vegetation community. To do so would require extensive understanding and research into the relationships between riparian plants and their physical, chemical, and biological environments. Recognize that this study was based solely on the response of the riparian vegetation to a single hydrologic variable at a single point in time. Not only are there a multitude of other hydrologic variables that influence riparian plant distributions, but there also exists a wide array of physical processes and environmental gradients that dictate species' occurrence and distribution. Little is known about the exact role and influence each of these processes play in the life of a single riparian plant, not to mention the obvious dynamic interrelationships that exist among the plants themselves.

The information provided by this analysis, however, is an initial step at understanding the complex relationship between riparian vegetation and hydrology. Furthermore, in the absence of more refined models, this type of analysis could be used to predict large scale shifts or trends of riparian vegetation in response to altered streamflows. Under a scenario of altered discharge, each new streamflow regime yields a different flow duration curve. Consequently, each riparian site is subject to a different set of hydrologic conditions which, with time, may support a different assemblage of vegetation.

Obviously, the most exciting and logical next step would be to validate and verify this methodology on a river system with a proposed water resource development project. Ideally, this model could be used to predict the response of riparian vegetation to altered streamflow conditions produced by the proposed diversion or impoundment. Subsequent analysis and monitoring would determine if the riparian vegetation responded to altered streamflow as predicted.

Conclusions

The relationship between streamside vegetation and the hydrology of the Middle Fork of the Flathead in Glacier National Park, Montana, indicates that plant position can indeed be related to frequency, intensity, and duration of flooding. Species most tolerant of flooding occurred in lower discharge classes and those less tolerant occurred in higher discharge classes. In short, this study provided evidence to clearly support and demonstrate:

1. an explicit link between vegetation and hydrology,
2. that the riparian vegetation along the Middle Fork Flathead River sorts along a hydrologic gradient,
3. that this hydrologic gradient, or set of hydrologic conditions necessary to support the natural assemblage of vegetation, can be quantified in terms of the magnitude, frequency, and duration of discharge, and
4. that this hydrologic gradient could be used to predict the distribution of riparian vegetation under altered hydrologic regimes.

One of the most important contributions of this research, however, can not be expressed in terms "results" or "meeting defined study goals and objectives." Though it hinges on successful results, perhaps the most significant contribution of this study was the methodology itself. The techniques and procedures defined here, and by relatively few others (e.g., Auble et al. 1991), present a means of integrating two very different disciplines. The fields of biology and engineering have traditionally developed and evolved independently of one another. Yet, this study combined principles from both of these fields to address an issue facing many engineers and resource managers today. Namely, what impact will proposed water development projects have on the surrounding biological communities. Given today's increasing demand for water and water resources by a variety of users, it is imperative that water managers agree upon a methodology to assess impacts associated with proposed developments. Hopefully, engineers and biologists alike will be able to support the techniques and procedures used in this study, and use them as a technical basis by which to communicate and address many of the issues facing water managers today.

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APPENDICES

APPENDIX A

SPECIES LIST

Table 18. List of riparian plant species encountered in vicinity of Nyack Flats, Middle Fork Flathead River, Montana. Willow (i.e., Salix) species are not identified. Unknown grass and forb species are listed as GUNK## (Grass UNKnown) and FUNK## (Forb UNKnown), respectively .

SPECIES #/CODE	SPECIES NAME	COMMON NAME
1 ACGL	Acer glabrum	Rocky Mountain maple
2 ACMI	Achillea millefolium	yarrow
3 ALTE	Alnus incana	thin-leafed alder
4 AMAL	Amelanchier alnifolia	serviceberry
5 ANAR	Angelica arguta	sharptooth angelica
6 ANMA	Anaphalis margaritacea	pearly-everlasting
7 ARCO	Arnica cordifolia	heart-leaf arnica
8 ARIN	Arnica chamissonis	leafy arnica
9 ARLU	Artemisia ludoviciana	western mugwort
10 ARUV	Arctostaphylos uva-ursi	kinnikinick
11 ASFO	Aster foliacous	leafy aster
12 ASMO	Aster modestus	great northern aster
13 BERE	Berberis repens	Oregon-grape
14 BI	Betula spp.	birch (tree)
15 BRIN	Bromus inermis	smooth brome
16 BUTTRCUP	Ranunculus spp.	buttercup
17 CAREX1	Carex spp.	sedge
18 CE	Thuja plicata	western red cedar
19 CERE	Centaurea maculosa	spotted knapweed
20 CHLE	Chrysanthemum leucanthemum	ox-eye daisy
21 CISPP	Cirsium spp.	thistle
22 CLCO	Clematis columbiana	Columbia virgin's-bower
23 COST	Cornus stolonifera	red-osier dogwood
24 CRDO	Crataegus douglasii	black hawthorn
25 CW	Populus trichocarpa	black cottonwood
26 DAGL	Dactylis glomerata	orchard grass
27 DF	Pseudotsuga menziesii	Douglas' fir
28 EPAN	Epilobium angustifolium	fireweed
29 EQAR	Equisetum spp.	horsetail
30 ES	Picea engelmannii x glauca	spruce
31 FRVI	Fragaria virginiana	strawberry
32 FUNK10		
33 FUNK3		
34 FUNK4		
35 FUNK5		
36 FUNK6		
37 FUNK7		
38 GUNK1		
39 GUNK10		
40 GUNK12		
41 GUNK3		
42 GUNK4		
43 GUNK5		
44 GUNK6		
45 GUNK7		
46 GUNK8		

Table 18. Continued.

#	SPECIES CODE	SPECIES NAME	COMMON NAME
47	HELA	Heracleum lanatum	cow-parsnip
48	LA	Larix occidentalis	western larch
49	LAPA	Lathyrus spp.	sweetpea
50	MEAL	Melilotus alba	white sweet-clover
51	MEOF	Melilotus officinalis	yellow seet-clover
52	MESPP	Medicago sativa	alfalfa
53	MULLEIN	Verbascum thapsus	common mullein
54	OPHO	Oplopanax horridum	devil's club
55	PAMY	Pachistima myrsinites	mountain boxwood
56	PHPR	Phleum pratense	common Timothy
57	POPA	Poa palustris	fowl bluegrass
58	POPR	Poa pratensis	Kentucky bluegrass
59	PRVI	Prunus virginiana	chokecherry
60	PTAQ	Pteridium aquilinum	bracken fern
61	RIIN	Ribes lacustre	swamp gooseberry
62	ROWO	Rosa woodsii	Wood's rose
63	RUPA	Rubus parviflorus	false raspberry
64	RUST	Rubus idaeus	red raspberry
65	SA	Abies lasiocarpa	subalpine fir
66	SALIX1	Salix	
67	SALIX2	Salix	
68	SALIX3	Salix	
69	SALIX4	Salix	
70	SALIX5	Salix	
71	SALIX6	Salix	
72	SALIX7	Salix	
73	SALIX8	Salix	
74	SARA	Sambucus racemosa	black elderberry
75	SESE	Senecio spp.	butterweed
76	SHCA	Shepherdia canadensis	Canadian buffaloberry
77	SMRA	Smilacina racemosa	feathery Solomon's
78	SOCA	Solidago canadensis	Canada goldenrod
79	SPBE	Spirea betulifolia	shiny-leafed spirea
80	STAM	Streptopus amplexifolius	twisted stalk
81	SYAL	Symphoricarpos albus	common snowberry
82	TAOF	Taraxacum officinale	common dandelion
83	THOC	Thalictrum occidentale	western meadowrue
84	TRIFOLIUM	Trifolium spp.	clover
85	URDI	Urtica dioica	stinging nettle
86	VAGL	Vaccinium globulare	dwarf huckleberry
87	WH	Tsuga heterophylla	western hemlock
88	WWP	Pinus monticola	western white pine
89	ACRU	Actaea rubra	baneberry
90	LP	Pinus contorta	lodgepole pine
91	FUNK9		

APPENDIX B

HEC-2 ANALYSIS

UNDERSTANDING HEC-2

HEC-2 is a computer simulation technique that computes water surface profiles and associated inundation areas for selected discharges. It was developed for calculating water surface profiles for steady, gradually varied flow in natural or constructed channels, and uses a numerical method, known as the "standard step method", to compute water surface elevations between adjacent channel cross-sections. Computation is based on the solution of the 1-dimensional energy equation between adjoining cross-sections.

Theoretical Basis and Assumptions

The following (after USDI-ACE 1990), briefly outlines the theoretical basis behind HEC-2. Conservation of energy is the dominant principle used in the water surface profile computations. That is, system energy is continuously accounted for between adjacent cross-sections; relying on the solution of the energy equation and energy loss equation between successive cross-sections. These two equations are given below, and are solved iteratively to calculate the unknown water surface elevation at an adjacent cross-section (Figure 33):

$$WS_2 + a_2V_2^2/2g = WS_1 + a_1V_1^2/2g + h_e \quad (6)$$

$$h_e = LS_f + C[a_2V_2^2/2g - a_1V_1^2/2g] \quad (7)$$

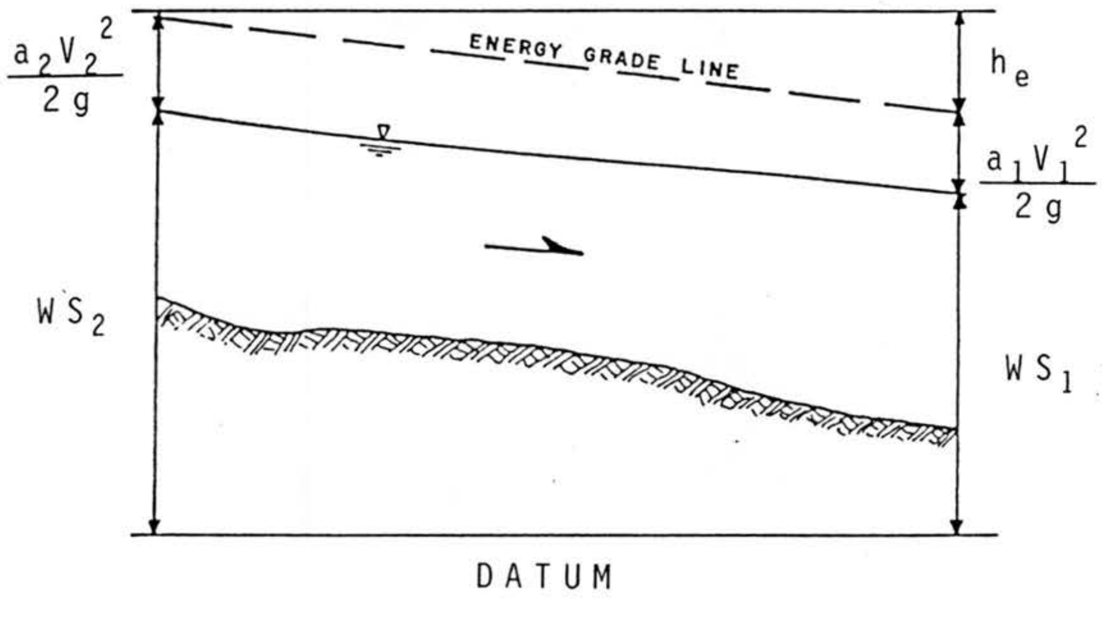


Figure 33. Profile view of typical reach (after USDI-ACE 1990).

where: WS_1, WS_2 = water surface elevation at cross-sections 1 and 2, respectfully

V_1, V_2 = mean velocity (total discharge / total flow area) at each cross-section

a_1, a_2 = velocity coefficients for flow at cross-sections 1 and 2, respectively; accounts for horizontal variations in velocity over the cross-section

g = acceleration of gravity

h_e = energy head loss between adjacent cross-sections

L = discharge weighted reach length

S_f = representative friction slope for the reach

C = expansion or contraction loss coefficient; accounts for energy head loss created by channel transitions.

The discharge weighted reach, L is defined as:

$$L = \frac{L_{lob}Q_{lob} + L_{ch}Q_{ch} + L_{rob}Q_{rob}}{Q_{lob} + Q_{ch} + Q_{rob}} \tag{8}$$

where L_{lob}, L_{ch}, L_{rob} = reach lengths (i.e., measured distance between adjacent cross-sections) of the left overbank, channel, and right overbank, respectively

Q_{rob}, Q_{ch}, Q_{rob} = average flow at each cross-section for the left overbank, main channel, and right overbank, respectively.

HEC-2 has four alternative expressions for the representative friction slope, S_f, for a given reach. Refer to the HEC-2 User's Manual (USDI-ACE 1990) for a full description of each equation. Friction loss is expressed as the product of the friction slope, S_f, and the discharge weighted reach length, L.

The computational procedure by which the unknown water surface elevation at a cross-section is determined is as follows:

1. Starting at the downstream-most cross-section, a water surface elevation at the next upstream cross-section is assumed.

2. Based on this assumed water surface elevation, the depth of flow, cross-sectional area, and mean velocity are computed; from these the corresponding total conveyance and velocity head are computed, where:

$$\text{conveyance, } k = \frac{1.486}{n} A\, R^{2/3} \tag{9}$$

where: A = flow area

R = hydraulic radius (area divided by wetted perimeter)

n = Manning's "n"

$$\text{and, velocity head} = aV^2/2g. \tag{10}$$

3. Using the values from step 2, the representative friction slope, S_f, is then computed and substituted into Equation 7 to solve for the energy head loss, h_e.
4. The values form steps 2 and 3 are then substituted into Equation 6 to solve for the water surface elevation at the upstream cross-section (i.e., WS_2).
5. The computed value of the water surface elevation at the upstream cross-section is then compared to the water surface elevation assumed in step 1; steps 1 through 5 are repeated until the values agree to within 0.01 meters (or 0.01 feet).

Once the "balanced" water surface elevation has been computed, the program determines if this elevation is above or below the critical water surface elevation (i.e., $V^2/2g < 1.0$ for subcritical flow). If the balanced water surface elevation is on the wrong side of the critical elevation, then critical depth is assumed and an error message is printed (USDI-ACE 1990). Assuming no errors, the basic and immediate output is a listing of balanced water surface elevations at each cross-section for each modeled discharge and flow regime.

Obviously each hydrologic model has a characteristic set of limiting assumptions, and HEC-2 is no exception. The methodology incorporated in the HEC-2 model is based on the following simplifying assumptions:

1. Steady flow. Steady flow is defined as flow with constant depth, velocity and discharge over a specified time interval. Steady flow is assumed because the energy equation does not incorporate time-dependent terms.

2. Gradually varied flow. Uniform flow is defined as flow with a constant depth and velocity along a specified length of channel (i.e., flow is neither accelerating or decelerating). Contrast this with varied flow in which depth and velocity change with distance along the stream. Gradually varied flow therefore, can be defined as flow with relatively minor changes in depth over a relatively long channel distance. Gradually varied flow is assumed because the energy equation assumes a hydrostatic pressure distribution exists at each cross-section. A hydrostatic pressure distribution, which does not hold for rapidly varied flow, is inherent in the assumption of steady, gradually varied flow.

3. Flow is one-dimensional. Flow is in the downstream direction, and does not account for velocity components in directions other than the direction of flow. One-dimensional flow is assumed because the conveyance equation (Equation 9) requires that the total energy head be the same for all points in a cross-section.

4. Stream gradients or channel slopes are small, usually less than 1:10. Small channel slopes are assumed because the pressure head is represented by the vertical measure of water depth. Pressure head is a component of the water surface elevations (WS terms) in Equation 6.

5. Rigid boundary conditions. Rigid boundary conditions are assumed because the program requires that energy losses be expressed with the terms in Equation 7. Therefore, the model is not capable of dealing with energy losses due to movable boundaries, and sediment transport.

Data Requirements

The data required to perform HEC-2 computations include: cross-sectional geometry of a series of transects located throughout the reach of interest; reach lengths (i.e., measured distances between the left overbank, right overbank, and channel of adjacent cross-sections); Manning's "n" values for the left overbank, right overbank, and streambed at each cross-section; discharge measurements across a range of flow magnitudes; water surface elevations at each cross-section at the time discharge measurements are taken, ideally this includes a starting water surface elevation at cross-section 1; assessment of the existing flow regime, either sub- or super- critical flow; and an estimate of contraction or expansion coefficients due to changes in channel cross-section.

Cross-sectional geometry of each cross-section was surveyed using a Lietz total-station instrument. Selected cross-sections represented a range of geomorphic landforms, hydrologic conditions and riparian vegetation. They were located according to the guidelines and recommendations outlined in the HEC-2 users manual (USDI-ACE 1990) and Hoggan (1989). A software package, TRAVERSE PC (Balcom and Ward 1990) was used to compute the X, Y, Z coordinates of all points along each cross-section. From this, it was possible to calculate the reach lengths for the left overbank, right overbank, and channel. Note that cross-section data is traditionally oriented looking downstream, and consequently all cross-section information was recorded in this manner. Several photographic slides and photos were taken of the entire reach and at several points along each cross-section. National Park Service hydrologists familiar with the study site used this information to collectively determine Manning's "n" values for the left overbank, right overbank, and streambed at each cross-section, according to the procedures outlined in Barnes (1967) and Arcement et al. (1989).

Stream discharge measurements were taken periodically throughout the 1990 and 1991 summer seasons at the downstream-most cross-section (i.e., HEC-2 cross-section number (1) using standard USGS boat discharge measurement techniques (Rantz 1982a and b). Table 19 (Appendix C) lists discharges and corresponding water surface elevations for all measurements taken at cross-section (1) during 1990 and 1991. Surveyed water surface elevations associated with discharges of 1200 and 13200 cfs, were also recorded at each of ten HEC-2 cross-sections.

Natural streams, and especially low gradient streams like the Middle Fork of the Flathead with few transitions (i.e., changes in cross-sectional configuration), tend to exhibit a sub-critical flow regime. For all HEC-2 runs subcritical flow was assumed, and expansion and contraction coefficients were set to the default values (i.e., 0.3 and 0.1 respectively). Expansion and contraction coefficients are multiplied by the absolute difference in velocity heads between cross-sections (Equation 7) to yield the energy head loss created by the transition (USDI-ACE 1990). With respect to the study site on the Middle Fork of the Flathead River, the change in effective cross-sectional area between any two adjacent cross-sections was small, and consequently the default settings were used (after USDI-ACE 1990).

Model Input

HEC-2 is capable of modeling multiple profiles and multiple cross-sections in a single run. Data is input as a series of cards, or records, and a variety of options (e.g., split flow, flow around bridges, channel improvement) are available to the user.

As an example of program input, the data set used to model flow at the Nyack study site is shown in Figure 34. T1 through T4 cards are merely comment cards or job identification cards. These are followed by a J1 record card; the 2 in the second column of the J1 card identifies the field on the QT card which contains the flow value to be modeled in the first profile. Note that the J1 card is required on all subsequent profiles (see the last lines of data input in Figure 34). The last column of the J1 card is the starting water surface elevation at cross-section 1, associated with the discharge listed in field 2 of the QT card. QT cards also list the discharges that will be modeled in subsequent runs.

```
T1   GLACIER NATIONAL PARK
T2   FIRST PROFILE
T3        MF FLATHEAD RIVER
T4   MARK WONDZELL  10-1-91
J1              2       0       0       0       0       0           3358.905
QT      2    1205   13200
J6      1              -1
NC      0       0       0      .1      .3
NH      4     .05   34.41     .03   164.4    .028  355.32    .045  835.26
X1      1      35    0.00  373.54       0       0       0
X3     10
GR3371.8    0.00 3370.90    5.45 3368.19   11.23 3363.05   18.10 3359.01   26.04
GR3357.2   28.56 3355.84   34.41 3356.59   43.84 3356.28   49.03 3355.86  115.72
GR3356.0  143.52 3356.35  164.40 3358.78  202.62 3359.96  205.22 3360.21  263.31
GR3360.0  264.67 3360.35  338.42 3357.96  344.07 3358.08  353.45 3357.79  355.32
GR3358.0  362.57 3361.90  364.17 3362.33  366.17 3364.64  367.67 3365.37  373.54
GR3364.1  448.48 3365.13  665.48 3359.14  679.18 3361.37  700.28 3361.29  724.18
GR3360.0  741.18 3363.03  747.08 3364.70  816.48 3364.69  817.28 3376.27  835.26
NH      4     .05    31.9     .03   217.4    .055  476.14    .045  940.11
X1      2      52    0.00  356.60 544.328  549.76  544.28
X3     10
GR3373.1    0.00 3371.26    6.20 3359.19   22.00 3357.04   25.50 3355.13   31.90
GR3356.0   44.20 3355.76   54.20 3355.61   61.20 3355.65   69.20 3355.52   76.20
GR3355.6   78.70 3355.58   85.20 3356.08   97.20 3356.32  101.30 3357.62  112.31
GR3359.1  149.82 3359.48  166.32 3359.41  188.51 3358.95  205.41 3359.43  217.40
GR3362.1  221.65 3363.60  231.00 3363.36  242.00 3363.78  258.40 3363.98  274.80
GR3363.3  291.20 3363.92  307.60 3363.86  323.80 3363.95  340.20 3364.18  356.60
GR3364.0  373.00 3363.18  389.40 3363.59  399.40 3362.51  405.80 3359.75  413.70
GR3358.8  422.20 3358.39  424.10 3357.72  438.60 3357.05  447.20 3357.51  449.90
GR3359.8  455.00 3363.87  459.20 3367.42  471.40 3369.28  476.14 3367.62  487.27
GR3368.5  503.53 3368.93  519.66 3366.09  536.06 3366.39  552.46 3367.67  784.64
GR3364.8  925.14 3372.63  940.11
NH      6     .05      34     .03    99.5    .028   263.1     .03   330.8     .04
NH    640    .045 1295.24
X1      3      73    0.00  552.20  867.31  545.32  856.79
X3     10
GR3375.7    0.00 3374.86    4.20 3372.03    9.50 3360.74   23.80 3357.15   29.20
GR3356.5   34.00 3357.39   42.00 3357.36   49.00 3357.62   55.00 3358.33   60.00
GR3358.5   65.00 3359.39   75.00 3360.46   99.50 3362.58  140.80 3362.69  163.00
GR3364.4  188.00 3364.06  190.00 3364.63  215.00 3364.03  223.00 3363.63  240.00
GR3363.5  246.50 3360.12  255.50 3360.73  263.10 3360.41  268.50 3358.83  287.30
GR3358.1  301.70 3357.67  307.99 3357.35  312.98 3357.66  322.99 3360.40  330.80
GR3365.5  335.00 3365.76  339.00 3365.77  355.40 3365.82  371.80 3365.81  388.20
GR3366.3  404.60 3366.57  421.00 3367.33  437.40 3367.90  453.80 3368.41  470.20
GR3368.9  486.60 3369.21  503.00 3369.22  519.40 3369.39  535.80 3369.77  552.20
GR3369.6  564.70 3369.49  568.60 3368.37  580.20 3367.29  585.00 3366.83  587.30
GR3366.9  601.40 3366.38  606.10 3365.15  610.00 3365.35  617.80 3366.16  624.10
GR3365.9  634.20 3366.21  635.70 3368.54  640.00 3369.84  650.60 3369.91  656.10
GR3369.0  658.00 3368.99  661.30 3369.73  663.90 3369.47  666.75 3371.06  683.20
GR3371.4  699.55 3370.69  715.95 3369.54  732.35 3370.05  748.75 3370.44  860.40
GR3370.1 1121.40 3368.38 1276.40 3376.54 1295.24
NH      4     .05    26.8     .03  334.68     .04   595.0    .045 1312.60
X1      4      53    0.00   513.0  483.33  182.53  476.88
X3     10
GR3376.3    0.00 3375.47    3.00 3374.21    6.00 3363.41   22.30 3361.06   26.80
GR3361.2   40.60 3361.62   49.50 3361.73   58.00 3362.18   79.00 3362.22  104.80
GR3362.5  147.00 3363.30  180.80 3363.63  195.00 3363.11  213.80 3362.89  234.70
GR3362.7  258.00 3362.25  278.00 3361.65  292.50 3360.92  305.50 3359.96  309.20
GR3359.3  313.43 3358.53  318.38 3359.34  334.68 3361.23  340.80 3365.25  345.80
GR3366.7  349.00 3366.74  351.50 3366.90  365.40 3366.82  381.80 3367.96  398.20
GR3368.3  414.60 3369.16  431.00 3369.59  447.40 3370.18  463.80 3370.58  480.20
GR3370.6  496.60 3370.72  513.00 3370.42  529.40 3369.68  540.30 3367.99  545.80
GR3367.7  550.40 3367.22  552.10 3366.72  562.20 3366.90  564.10 3370.05  569.40
GR3370.8  578.60 3370.92  595.00 3369.93  611.40 3370.04  627.80 3370.36  644.20
GR3370.4  660.60 3368.38 1293.60 3376.54 1312.60
NH      4     .05    16.3    .036   176.0     .03   388.5    .045  677.17
X1      5      36    0.00   405.5 2483.92 2306.46 2478.78
GR3384.3    0.00 3383.35    4.00 3374.40   16.30 3373.69  150.00 3372.38  160.80
GR3372.0  167.50 3370.36  176.00 3369.69  184.80 3368.71  191.30 3368.43  195.20
GR3368.7  198.80 3369.69  205.30 3368.91  221.00 3368.19  244.30 3367.29  252.80
GR3365.8  264.50 3365.95  274.05 3366.70  287.08 3366.78  341.43 3366.35  356.43
GR3365.4  366.37 3364.47  375.31 3365.47  380.40 3368.88  388.50 3372.49  395.00
GR3379.9  405.50 3379.69  407.50 3381.21  427.10 3379.43  452.00 3381.12  468.50
```

Figure 34. Example of HEC-2 input data file used to model flows through the Nyack study reach, Middle Fork Flathead River, Montana.

```
GR3379.5  481.50 3378.28  512.70 3378.55  539.30 3380.85  562.70 3380.49  652.70
GR3387.0  677.17
NH     5    .052   30.00     .04  349.00    .051  381.40    .032  461.00    .045
NH554.47
X1     6      33    0.00  554.47  531.35  616.58  587.29
GR3388.0    0.00 3387.38    4.00 3375.62   20.50 3370.76   30.00 3371.50   46.20
GR3373.3   81.70 3370.91  130.80 3370.17  151.80 3369.42  164.00 3369.01  194.00
GR3369.1  220.34 3369.04  266.56 3369.28  291.18 3370.56  311.06 3369.97  315.32
GR3368.0  322.14 3367.67  330.14 3369.19  342.32 3369.92  349.00 3373.90  353.00
GR3375.6  366.80 3374.74  374.40 3370.01  381.40 3368.64  385.50 3367.96  402.20
GR3366.6  413.00 3365.28  421.30 3363.28  437.30 3365.92  449.80 3370.00  461.00
GR3377.5  469.80 3378.09  500.00 3388.28  554.47
NH     9    .056   44.48    .035  218.20     .04  267.50    .031  316.90    .045
NH709.38    .030  774.98    .037  827.08    .035  853.68    .045  884.18
X1     7      78    0.00  884.18  346.56  389.78  406.33
GR3388.9    0.00 3387.66    6.79 3376.24   20.30 3371.25   30.28 3372.42   44.48
GR3371.5   48.21 3371.02   50.90 3370.32   60.50 3370.52   69.60 3368.62   89.20
GR3368.5  127.00 3369.02  149.80 3369.32  174.10 3369.52  188.90 3370.42  205.50
GR3371.4  210.10 3372.02  212.20 3372.92  218.20 3374.52  234.70 3374.32  251.10
GR3374.2  263.20 3372.32  267.50 3370.72  271.30 3370.52  276.30 3369.82  283.90
GR3369.1  293.90 3370.52  300.50 3373.62  308.10 3375.02  316.90 3375.72  320.10
GR3378.8  323.30 3379.72  333.20 3379.72  349.60 3378.82  362.60 3377.02  365.70
GR3376.5  367.30 3376.52  375.70 3377.12  382.20 3377.92  398.70 3377.72  415.10
GR3378.8  431.60 3379.20  448.00 3378.40  464.60 3378.10  480.80 3378.60  489.80
GR3380.1  497.30 3379.90  513.70 3380.40  529.90 3381.20  546.20 3382.18  562.38
GR3382.4  578.68 3380.58  587.08 3379.88  594.98 3379.38  611.48 3378.08  627.78
GR3376.8  644.08 3376.98  649.88 3377.68  660.38 3376.68  673.18 3376.38  676.68
GR3376.2  693.18 3375.38  709.38 3372.38  710.88 3371.48  716.78 3372.28  725.48
GR3372.1  741.88 3371.18  758.28 3372.88  774.98 3374.48  791.28 3374.08  807.68
GR3373.0  823.58 3373.08  827.08 3369.98  840.28 3370.28  846.58 3376.58  853.68
GR3377.7  856.88 3385.18  873.18 3394.68  884.18
NH     8    .056   29.43    .035  155.67     .04  248.06    .031  292.48    .045
NH619.48    .053  766.48    .030  827.28    .045  847.95
X1     8      84    0.00  847.95   66.90   91.78   93.19
GR3382.9    0.00 3379.38    8.00 3371.59   17.32 3370.18   20.93 3369.41   24.48
GR3370.0   29.43 3367.71   31.36 3366.43   33.40 3365.46   35.40 3364.34   39.40
GR3365.7   45.40 3367.47   50.40 3368.39   55.40 3369.22   64.69 3369.04   89.73
GR3369.1  103.96 3369.17  120.40 3369.81  139.50 3371.57  152.39 3372.99  155.67
GR3372.9  163.00 3373.60  166.25 3373.61  179.35 3374.25  195.58 3375.01  199.95
GR3375.2  212.00 3375.00  228.40 3374.48  244.80 3374.37  248.06 3372.97  252.84
GR3372.0  257.45 3371.56  260.96 3370.56  270.40 3369.93  277.40 3370.57  284.04
GR3375.3  292.48 3380.98  300.47 3381.48  308.94 3379.81  325.37 3379.92  341.73
GR3380.2  358.11 3378.59  374.23 3379.43  390.63 3378.35  406.83 3379.30  423.09
GR3379.4  439.42 3378.66  455.50 3379.50  472.04 3381.90  488.24 3381.81  504.70
GR3379.7  521.00 3381.77  537.20 3382.57  553.70 3383.17  570.20 3385.67  586.60
GR3382.4  603.18 3382.46  609.98 3376.86  619.48 3375.66  635.98 3374.06  640.78
GR3374.8  649.18 3376.06  652.18 3376.36  668.88 3377.76  685.08 3377.36  690.98
GR3379.4  699.18 3378.46  701.28 3376.42  710.88 3373.62  716.08 3373.72  717.58
GR3376.0  726.68 3375.72  733.98 3377.32  750.58 3377.82  766.48 3372.06  779.28
GR3371.7  783.08 3370.96  799.18 3368.66  813.38 3368.96  816.08 3370.96  823.48
GR3371.4  826.38 3375.47  827.28 3378.71  833.78 3389.95  847.95
NH     8    .045    12.9    .035   129.6    .030   207.8    .028   310.3    .035
NH 359.5    .056  704.62    .030  799.72    .045  820.12
X1     9      74    0.00  820.12  838.19  815.71  836.10
GR3382.9    0.00 3382.03    6.70 3374.39   12.90 3373.69   14.70 3371.99   19.40
GR3371.1   26.00 3370.39   34.60 3369.89   43.40 3369.49   46.50 3369.69   53.60
GR3369.9   62.00 3369.99   65.60 3370.19   76.80 3370.09   92.50 3370.09   99.90
GR3370.2  110.30 3371.19  115.80 3373.69  121.40 3378.19  129.60 3377.39  147.60
GR3379.2  152.20 3378.89  162.60 3377.79  179.00 3376.29  195.50 3376.09  202.30
GR3374.3  207.80 3374.49  211.90 3374.89  228.50 3375.19  244.90 3375.39  261.20
GR3375.1  277.60 3374.69  294.00 3374.49  310.30 3373.89  327.20 3374.59  343.10
GR3376.3  359.50 3377.49  368.60 3377.79  375.90 3378.32  392.32 3379.62  408.72
GR3381.2  420.42 3381.42  425.02 3379.72  436.92 3379.72  441.52 3380.12  457.72
GR3379.5  474.02 3382.12  490.82 3380.42  507.62 3380.42  524.22 3380.82  534.12
GR3379.1  540.12 3379.69  556.72 3380.39  572.92 3380.69  589.42 3380.69  605.62
GR3379.7  622.12 3380.01  638.72 3380.61  655.12 3380.81  671.62 3380.71  688.22
GR3380.7  704.62 3379.71  720.92 3379.41  737.52 3377.81  741.62 3376.01  742.22
GR3375.4  744.82 3375.01  754.02 3374.41  770.42 3373.91  786.82 3372.81  798.42
GR3378.0  799.72 3380.21  803.92 3381.81  810.22 3387.41  820.12
```

Figure 34. Continued.

```
NH      5     .045     18.1     .035     86.3     .031    155.4     .040   296.11     .045
NH324.98
X1     10       38     0.00   324.98  1030.17  1146.52  1153.02
GR3385.2     0.00  3382.66     8.30  3380.26     9.20  3379.36    12.70  3377.06    18.10
GR3375.2    37.40  3374.16    45.00  3373.56    53.40  3373.86    58.50  3373.76    61.10
GR3374.3    66.00  3374.86    70.30  3375.26    75.30  3375.56    77.80  3376.36    81.40
GR3377.1    86.30  3379.16    90.00  3378.96   109.20  3378.16   125.40  3377.76   142.80
GR3377.8   155.40  3377.16   159.80  3376.16   165.70  3375.66   179.70  3375.36   189.80
GR3375.3   206.40  3375.06   224.30  3375.06   233.50  3375.36   247.10  3376.16   254.90
GR3375.8   269.00  3375.96   275.60  3375.26   282.10  3376.36   289.40  3376.56   293.60
GR3377.5   296.11  3380.06   303.50  3395.46   324.98
EJ

T1   GLACIER NATIONAL PARK
T2   SECOND PROFILE
T3        MF FLATHEAD RIVER
J1               3        0        0        0        0        0           3363.24
J2      2
ER
```

Figure 34. Continued.

A "1" in the first column of the J6 card allows the program to select, on a reach-by-reach basis, the appropriate friction loss equation for each cross-section. A "-1" in column 3 allows the program to subdivide the channel cross-section according to the Manning's "n" values input on the NH card. Columns 4 and 5 of the NC card are the default settings for the contraction and expansion coefficients, respectively. The value in column 1 of the NH card indicates the number of Manning's "n" values that follow; the actual Manning's "n" value is entered followed by the distance from the left headpin for which that value applies. For example, there are 4 Manning's "n" values on the first NH card. A value of n=0.05 extends from 0.00 to 34.41 feet from the headpin, and n=0.03 extends form 34.41 feet to 164.4 feet, and so on, until the right headpin is encountered (i.e., end of the transect or cross-section). The X1 card indicates the cross-section number (column 1) and the horizontal position of the left and right edge of channel (columns 2 and 4, respectively).

The X3 card is not required, but takes advantage of one of the options available to the user. A "10" in column 1 insures that the modeled flow is contained between the left and right edge of the channel until one, or the other, of the banks are overtopped. This feature was particularly helpful when modeling flow in the Middle Fork of the Flathead River. In many instances there existed an old abandoned side channel with a minimum streambed elevation much lower than the bank elevation of the existing active channel. Without this feature, a portion of the modeled flow would have been routed through this abandoned channel, and not down the main channel. In actuality, the only way these abandoned channels can be wetted today is by overtopping the banks of the existing channel.

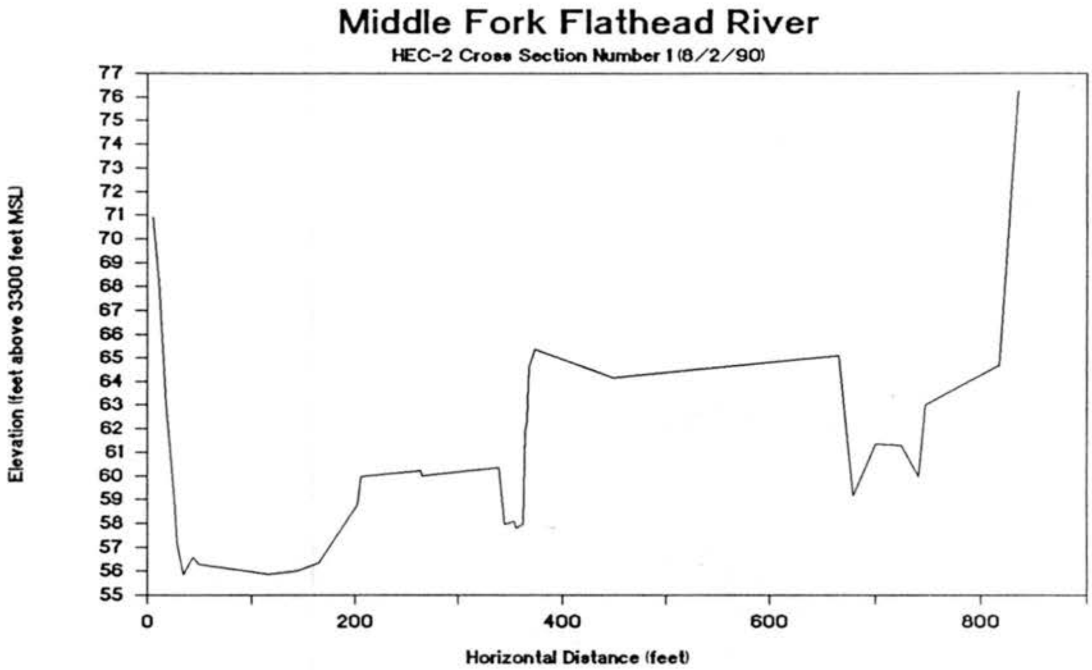
The GR record cards give, as a pair, the elevation and distance from the headpin of each surveyed point along the cross-section. During the actual field survey, the channel and adjacent floodplain were surveyed at each and every major slope break, and change in streambed elevation. These cross-sectional profiles can be seen in Figures 35 to 39.

Following the initial set of T1-T4, J1, QT, J6 and NC cards, the sequence of NH, X1, X3, and GR cards is repeated for each of the ten cross-sections. Following these, is a set of cards which identify subsequent profiles or runs. These cards give the discharge to be modeled and the slope of the water surface profile, or starting water surface elevation. The slope of the water surface profile is used to determine the starting water surface elevation for all discharges except 1200 and 13200 cfs. Recall that these discharges (1200 and 13200) were measured in the field and the water surface elevations were surveyed and recorded at that time. These surveyed elevations are shown on the J1 cards of each respective profile.

Model Calibration and Sensitivity Analysis

Even though the balanced water surface elevation may agree with the assumed initial starting water surface elevation, it may not agree with the surveyed water surface elevation. In other words, the computed balanced water surface elevations may not agree with those observed at each cross-section for that particular discharge. Model parameters (namely Manning's "n") are therefore adjusted until the energy-balanced water surface elevations approach, or "agree with", the observed water surface elevations (Bovee and Milhous 1978).

Several trials or runs were conducted with small changes in Manning's "n", alternative friction slope equations, and adding interpolated cross-sections, in an attempt to achieve the smallest difference between the computed water surface elevations and known water surface elevations. For



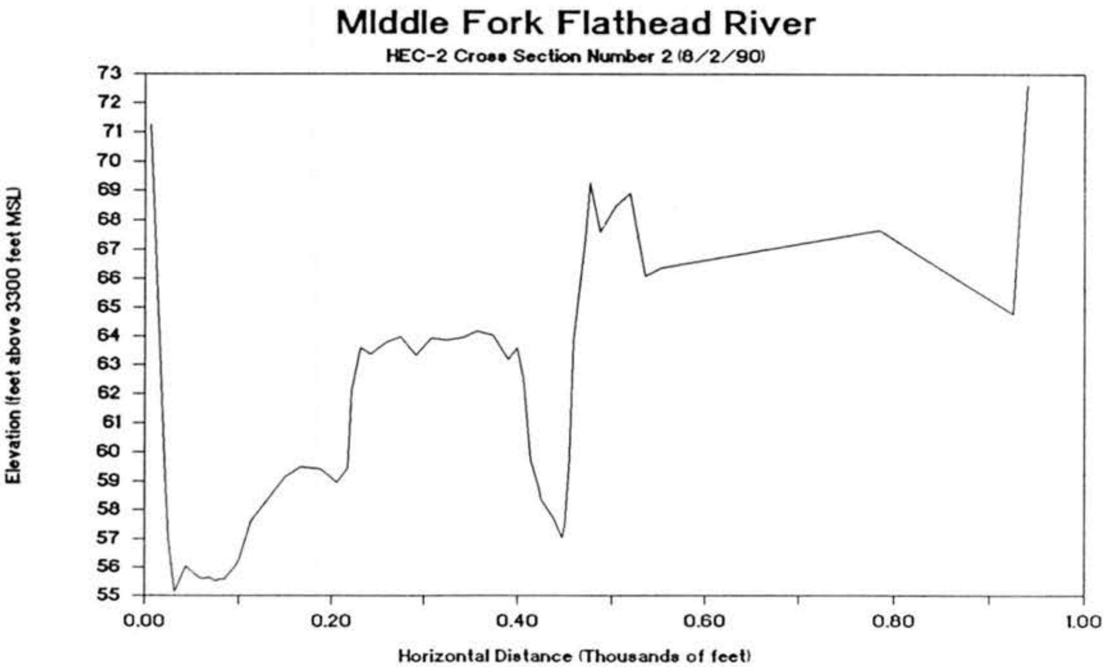
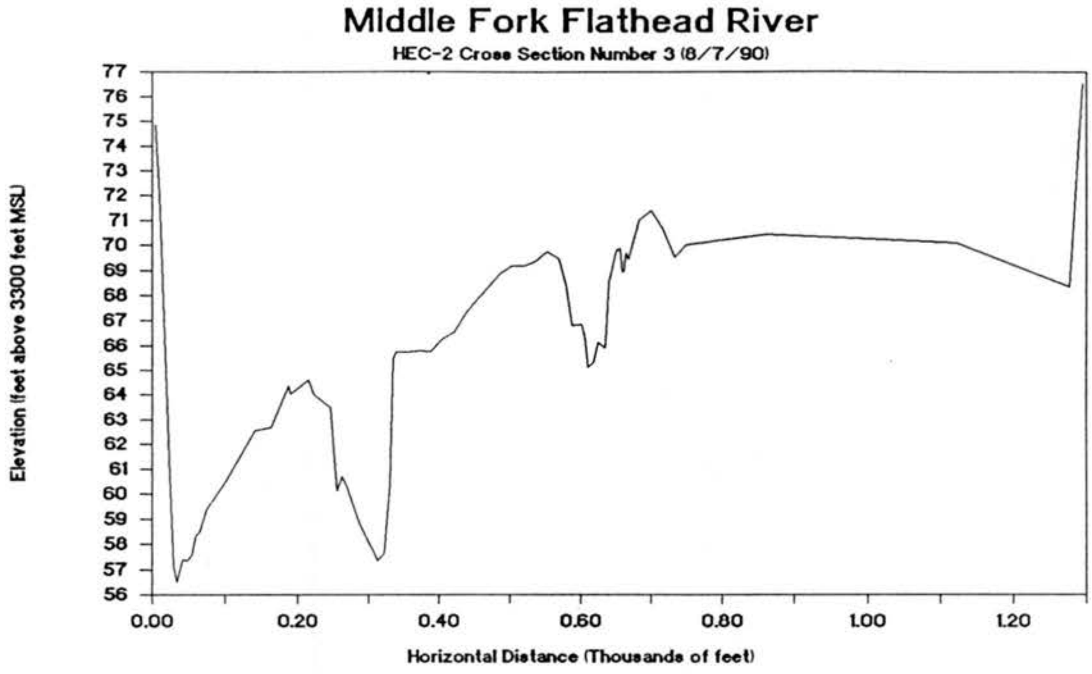


Figure 35. Cross-sectional profile of HEC-2 cross-sections 1 and 2.



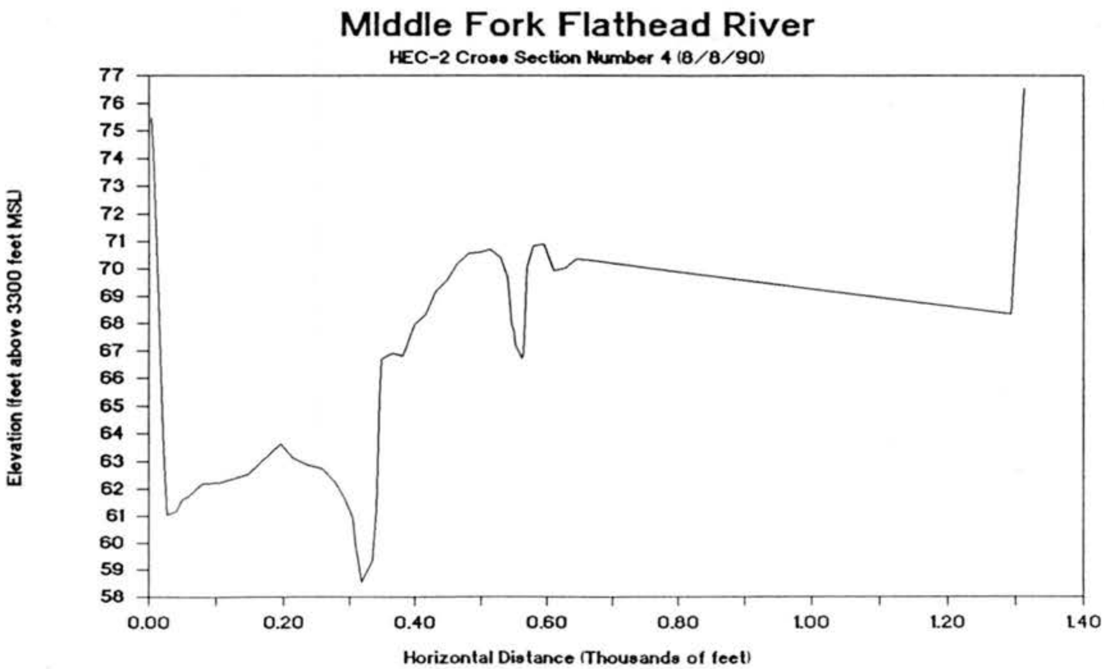
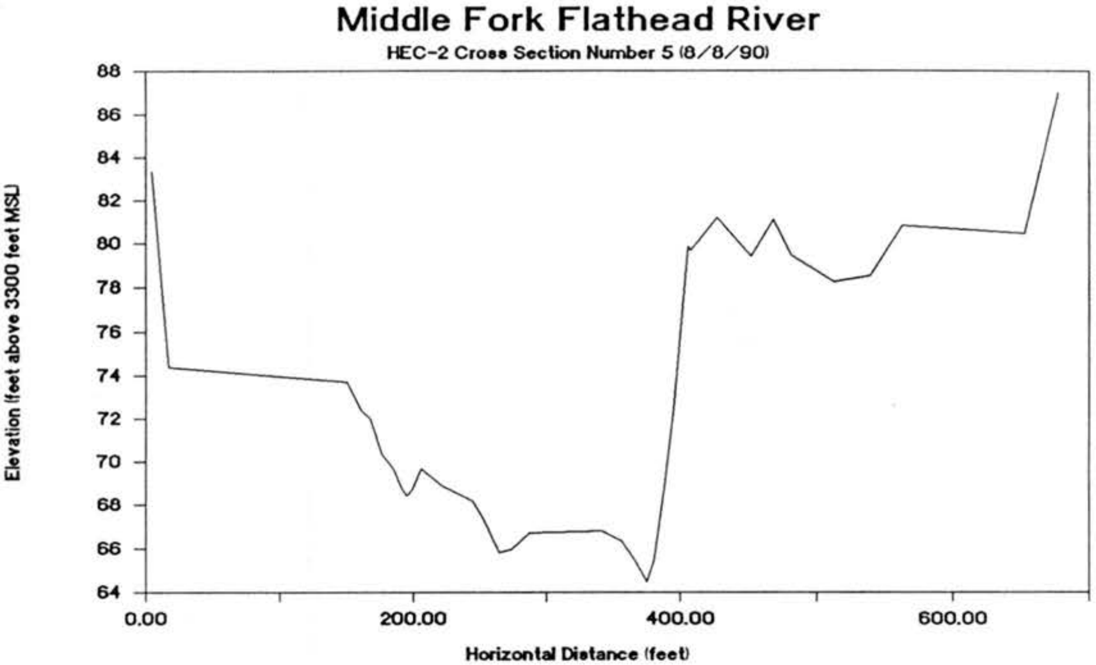


Figure 36. Cross-sectional profile of HEC-2 cross-sections 3 and 4.



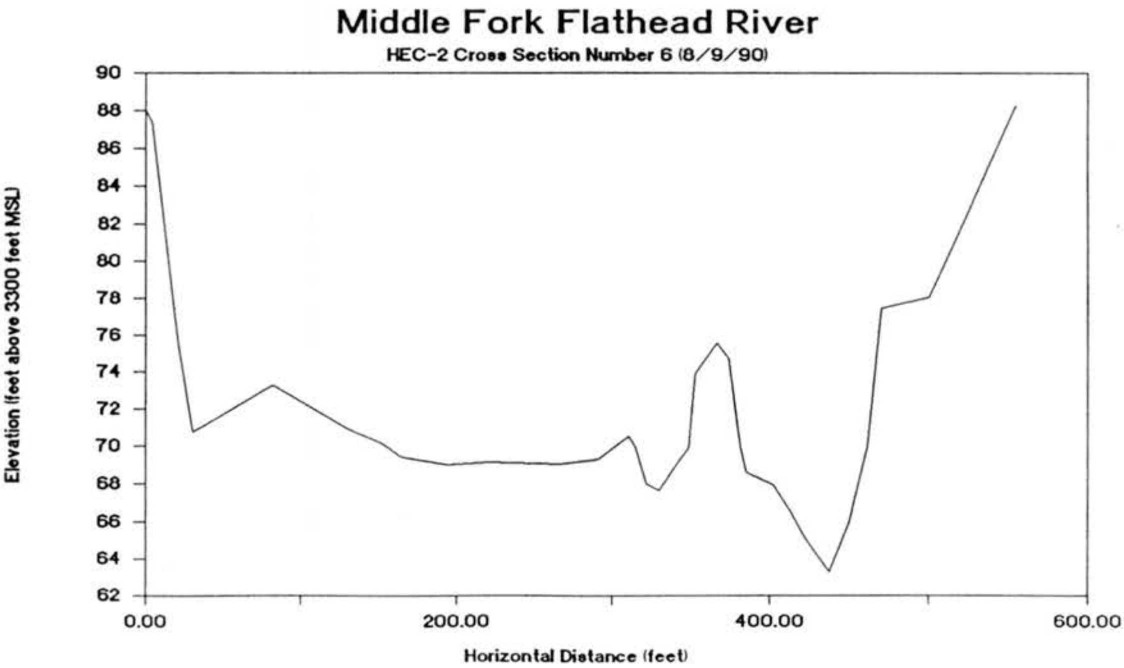
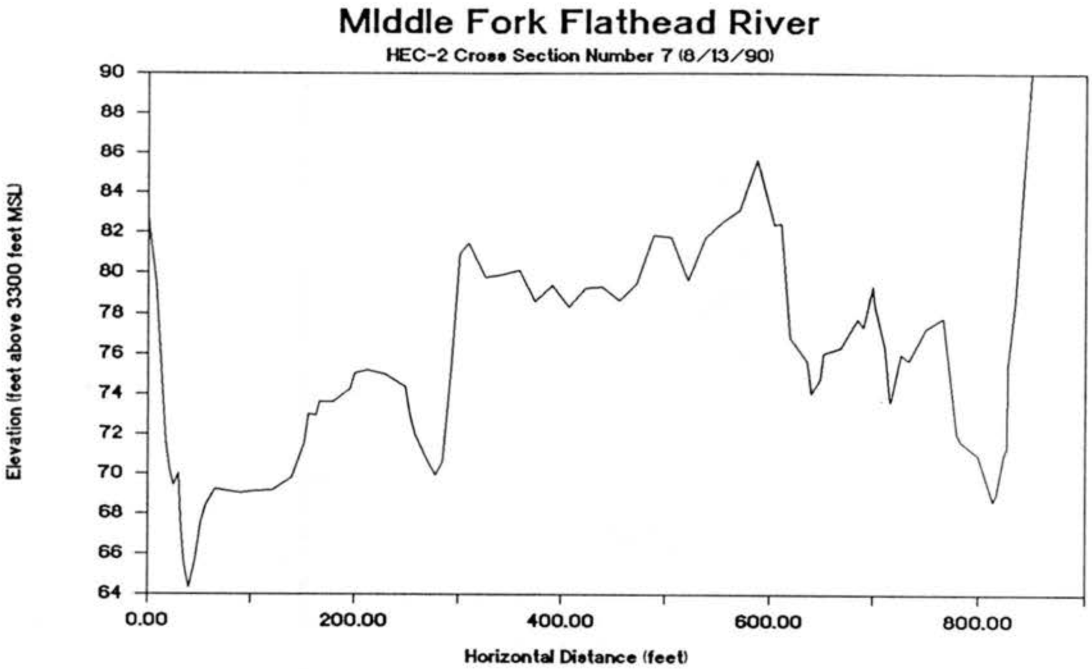


Figure 37. Cross-sectional profile of HEC-2 cross-sections 5 and 6.



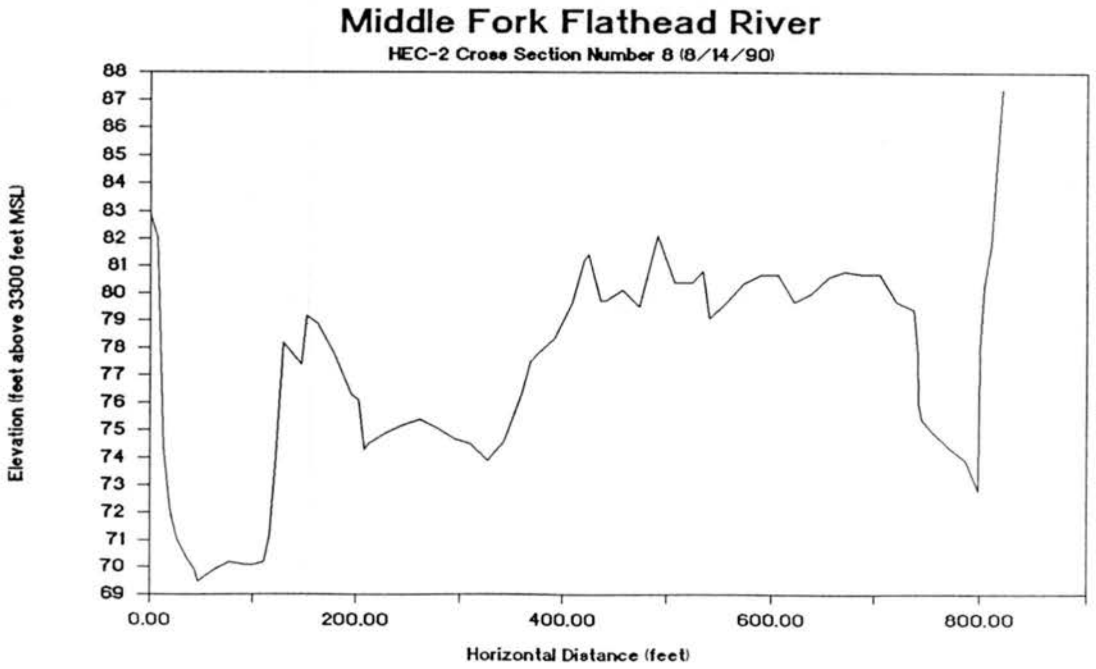
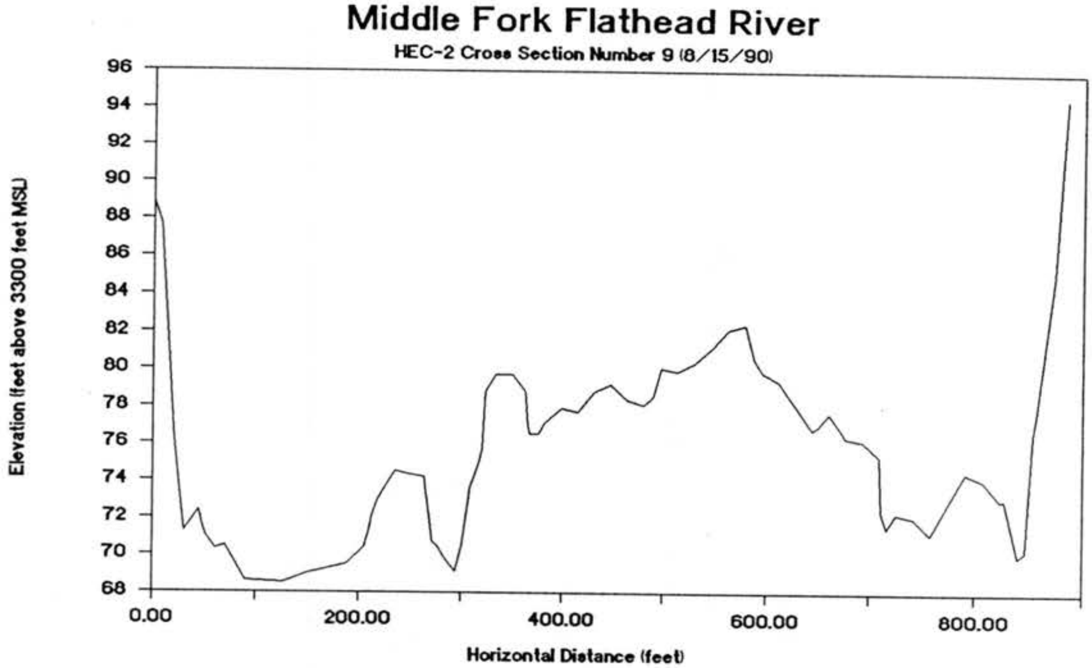


Figure 38. Cross-sectional profile of HEC-2 cross-sections 7 and 8.



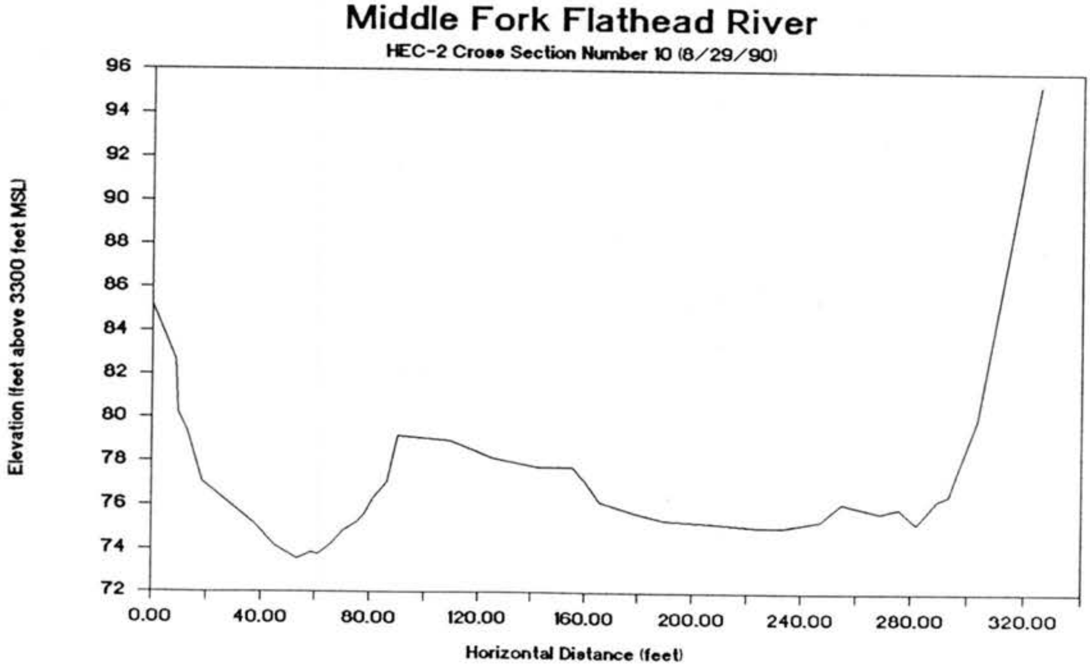


Figure 39. Cross-sectional profile of HEC-2 cross-sections 9 and 10.

example, separate runs were made using each of 4 available friction loss equations. Each run produced results (i.e., computed water surface elevations) almost identical to those produced in the initial run in which the program selected the appropriate friction loss equation on a reach by reach basis.

Likewise, the average slope of the water surface (0.0025) was substituted for the known starting water surface elevation (at Q = 13200) to test model performance at higher discharges when the starting water surface elevation is unknown. Again, the results of this run proved almost identical to those generated when the known starting water surface elevation was used. Subsequent runs were made in which the water surface slope varied from 0.01 to 0.0001. Model output (i.e., computed water surface elevations) did not appear to be sensitive to small changes in slope (e.g., .001 to 0.0035), however, when the slope changed more than one order of magnitude and was outside the credible range (e.g., 0.0001, or 0.01), the computed water surface elevations changed dramatically. Similarly, several trials were also conducted in which Manning's "n" values were changed, and interpolated cross-sections added. Again, the model appeared to be sensitive only to significant, unrealistic changes in "n". Likewise, the addition of interpolated cross-sections failed to improve model performance.

Of all the different trials or runs conducted, the initial run, with the original estimates of Manning's "n", friction slope equation, and lack of interpolated cross-sections, produced the best results in terms of 1) the smallest difference between computed and observed water surface elevations, 2) fewest warnings and/or caution messages, and 3) the smallest and fewest conveyance warnings. Table 13 compares computed water surface elevations to known or observed water surface elevations for all ten HEC-2 cross-sections at the two measured discharges of 1200 and 13200 cfs. Once calibrated, model parameters were held constant, and water surface profiles were computed for all other discharges of interest.

Model Output

The HEC-2 output from the Middle Fork of the Flathead River for all 14 modeled discharges is much too voluminous to be included here. The reader is referred to the HEC-2 User's Manual (USDI-ACE 1990) for examples of HEC-2 output and an idea of the wide variety of available output control options. HEC-2 output corresponding to the input data described earlier and presented in Figure 34, is shown in Figure 40. As noted earlier, the initial output is a listing of the computed "balanced" water surface elevations at each cross-section for each modeled discharge. The bulk of the output, however, includes a detailed listing of input data and output variables for each profile, followed by a summary printout and error messages. Longitudinal and cross-sectional profile plots are also generated for the entire reach and each individual cross-section. The user can choose from any number of output variables that apply to any cross-section. An example of possible output is shown in the summary tables at the end of Figure 40. These tables include much information other than just computed water surface elevation. For example, they could include: depth of flow; discharge-weighted velocity head for a cross-section; total flow in the cross-section, left overbank, right overbank, or main channel; boundary shear stress within the channel; mean velocity in the main channel, or left, or right overbank; and the slope of the energy grade line.

Recall that in this study HEC-2 was used to generate a series of water surface elevations associated with a range of discharges. This was the ultimate purpose of HEC-2, and from this information it was possible to generate a stage-discharge relationship at each cross-section. From these relationships it was then possible to determine the minimum inundating discharge of each plot located along the cross-section.

```
*********************************************                                              ****************************************
*  HEC-2 WATER SURFACE PROFILES             *                                              *  U.S. ARMY CORPS OF ENGINEERS        *
*                                           *                                              *  HYDROLOGIC ENGINEERING CENTER       *
*  Version   4.5.1;  September 1990         *                                              *  609 SECOND STREET, SUITE D          *
*                                           *                                              *  DAVIS, CALIFORNIA 95616-4687        *
*  RUN DATE    01OCT91    TIME   05:20:39   *                                              *         (916) 756-1104               *
*********************************************                                              ****************************************


                                     X     X  XXXXXXX   XXXXX             XXXXX
                                     X     X  X        X     X           X     X
                                     X     X  X        X                       X
                                     XXXXXXX  XXXX     X        XXXXX     XXXXX
                                     X     X  X        X                 X
                                     X     X  X        X     X           X
                                     X     X  XXXXXXX   XXXXX            XXXXXXX


                                                                                      THIS RUN EXECUTED 01OCT91    05:20:39
**************************************
 HEC-2 WATER SURFACE PROFILES
 Version   4.5.1;  September 1990
**************************************


T1   GLACIER NATIONAL PARK
T2   FIRST PROFILE
T3       MF FLATHEAD RIVER
T4   MARK WONDZELL 10-1-91
J1   ICHECK      INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                   2         0         0         0         0         0          3358.905
QT        2     1205     13200
J6   IHLEQ      ICOPY     SUBDIV    STRTDS    RMILE
       1                   -1
NC        0        0         0        .1        .3
NH        4      .05     34.41       .03     164.4      .028    355.32      .045    835.26
X1        1       35      0.00    373.54         0         0         0
X3       10
GR   3371.8     0.00   3370.90      5.45   3368.19     11.23   3363.05     18.10   3359.01     26.04
GR   3357.2    28.56   3355.84     34.41   3356.59     43.84   3356.28     49.03   3355.86    115.72
GR   3356.0   143.52   3356.35    164.40   3358.78    202.62   3359.96    205.22   3360.21    263.31
GR   3360.0   264.67   3360.35    338.42   3357.96    344.07   3358.08    353.45   3357.79    355.32
GR   3358.0   362.57   3361.90    364.17   3362.33    366.17   3364.64    367.67   3365.37    373.54
GR   3364.1   448.48   3365.13    665.48   3359.14    679.18   3361.37    700.28   3361.29    724.18
GR   3360.0   741.18   3363.03    747.08   3364.70    816.48   3364.69    817.28   3376.27    835.26
```

Figure 40. Example of HEC-2 output, generated from the input data file shown in Figure 34.

NH	4	.05	31.9	.03	217.4	.055	476.14	.045	940.11	
X1	2	52	0.00	356.60	544.328	549.76	544.28			
X3	10									
GR	3373.1	0.00	3371.26	6.20	3359.19	22.00	3357.04	25.50	3355.13	31.90
GR	3356.0	44.20	3355.76	54.20	3355.61	61.20	3355.65	69.20	3355.52	76.20
GR	3355.6	78.70	3355.58	85.20	3356.08	97.20	3356.32	101.30	3357.62	112.31
GR	3359.1	149.82	3359.48	166.32	3359.41	188.51	3358.95	205.41	3359.43	217.40
GR	3362.1	221.65	3363.60	231.00	3363.36	242.00	3363.78	258.40	3363.98	274.80
GR	3363.3	291.20	3363.92	307.60	3363.86	323.80	3363.95	340.20	3364.18	356.60
GR	3364.0	373.00	3363.18	389.40	3363.59	399.40	3362.51	405.80	3359.75	413.70
GR	3358.8	422.20	3358.39	424.10	3357.72	438.60	3357.05	447.20	3357.51	449.90
GR	3359.8	455.00	3363.87	459.20	3367.42	471.40	3369.28	476.14	3367.62	487.27
GR	3368.5	503.53	3368.93	519.66	3366.09	536.06	3366.39	552.46	3367.67	784.64
GR	3364.8	925.14	3372.63	940.11						
NH	6	.05	34	.03	99.5	.028	263.1	.03	330.8	.04
NH	640	.045	1295.24							
X1	3	73	0.00	552.20	867.31	545.32	856.79			
X3	10									
GR	3375.7	0.00	3374.86	4.20	3372.03	9.50	3360.74	23.80	3357.15	29.20
GR	3356.5	34.00	3357.39	42.00	3357.36	49.00	3357.62	55.00	3358.33	60.00
GR	3358.5	65.00	3359.39	75.00	3360.46	99.50	3362.58	140.80	3362.69	163.00
GR	3364.4	188.00	3364.06	190.00	3364.63	215.00	3364.03	223.00	3363.63	240.00
GR	3363.5	246.50	3360.12	255.50	3360.73	263.10	3360.41	268.50	3358.83	287.30
GR	3358.1	301.70	3357.67	307.99	3357.35	312.98	3357.66	322.99	3360.40	330.80
GR	3365.5	335.00	3365.76	339.00	3365.77	355.40	3365.82	371.80	3365.81	388.20
GR	3366.3	404.60	3366.57	421.00	3367.33	437.40	3367.90	453.80	3368.41	470.20
GR	3368.9	486.60	3369.21	503.00	3369.22	519.40	3369.39	535.80	3369.77	552.20
GR	3369.6	564.70	3369.49	568.60	3368.37	580.20	3367.29	585.00	3366.83	587.30
GR	3366.9	601.40	3366.38	606.10	3365.15	610.00	3365.35	617.80	3366.16	624.10
GR	3365.9	634.20	3366.21	635.70	3368.54	640.00	3369.84	650.60	3369.91	656.10
GR	3369.0	658.00	3368.99	661.30	3369.73	663.90	3369.47	666.75	3371.06	683.20
GR	3371.4	699.55	3370.69	715.95	3369.54	732.35	3370.05	748.75	3370.44	860.40
GR	3370.1	1121.40	3368.38	1276.40	3376.54	1295.24				
NH	4	.05	26.8	.03	334.68	.04	595.0	.045	1312.60	
X1	4	53	0.00	513.0	483.33	182.53	476.88			
X3	10									
GR	3376.3	0.00	3375.47	3.00	3374.21	6.00	3363.41	22.30	3361.06	26.80
GR	3361.2	40.60	3361.62	49.50	3361.73	58.00	3362.18	79.00	3362.22	104.80
GR	3362.5	147.00	3363.30	180.80	3363.63	195.00	3363.11	213.80	3362.89	234.70
GR	3362.7	258.00	3362.25	278.00	3361.65	292.50	3360.92	305.50	3359.96	309.20
GR	3359.3	313.43	3358.53	318.38	3359.34	334.68	3361.23	340.80	3365.25	345.80
GR	3366.7	349.00	3366.74	351.50	3366.90	365.40	3366.82	381.80	3367.96	398.20
GR	3368.3	414.60	3369.16	431.00	3369.59	447.40	3370.18	463.80	3370.58	480.20
GR	3370.6	496.60	3370.72	513.00	3370.42	529.40	3369.68	540.30	3367.99	545.80
GR	3367.7	550.40	3367.22	552.10	3366.72	562.20	3366.90	564.10	3370.05	569.40
GR	3370.8	578.60	3370.92	595.00	3369.93	611.40	3370.04	627.80	3370.36	644.20
GR	3370.4	660.60	3368.38	1293.60	3376.54	1312.60				

Figure 40. Continued.

NH	4	.05	16.3	.036	176.0	.03	388.5	.045	677.17	
X1	5	36	0.00	405.5	2483.92	2306.46	2478.78			
GR	3384.3	0.00	3383.35	4.00	3374.40	16.30	3373.69	150.00	3372.38	160.80
GR	3372.0	167.50	3370.36	176.00	3369.69	184.80	3368.71	191.30	3368.43	195.20
GR	3368.7	198.80	3369.69	205.30	3368.91	221.00	3368.19	244.30	3367.29	252.80
GR	3365.8	264.50	3365.95	274.05	3366.70	287.08	3366.78	341.43	3366.35	356.43
GR	3365.4	366.37	3364.47	375.31	3365.47	380.40	3368.88	388.50	3372.49	395.00
GR	3379.9	405.50	3379.69	407.50	3381.21	427.10	3379.43	452.00	3381.12	468.50
GR	3379.5	481.50	3378.28	512.70	3378.55	539.30	3380.85	562.70	3380.49	652.70
GR	3387.0	677.17								
NH	5	.052	30.00	.04	349.00	.051	381.40	.032	461.00	.045
NH	554.47									
X1	6	33	0.00	554.47	531.35	616.58	587.29			
GR	3388.0	0.00	3387.38	4.00	3375.62	20.50	3370.76	30.00	3371.50	46.20
GR	3373.3	81.70	3370.91	130.80	3370.17	151.80	3369.42	164.00	3369.01	194.00
GR	3369.1	220.34	3369.04	266.56	3369.28	291.18	3370.56	311.06	3369.97	315.32
GR	3368.0	322.14	3367.67	330.14	3369.19	342.32	3369.92	349.00	3373.90	353.00
GR	3375.6	366.80	3374.74	374.40	3370.01	381.40	3368.64	385.50	3367.96	402.20
GR	3366.6	413.00	3365.28	421.30	3363.28	437.30	3365.92	449.80	3370.00	461.00
GR	3377.5	469.80	3378.09	500.00	3388.28	554.47				
NH	9	.056	44.48	.035	218.20	.04	267.50	.031	316.90	.045
NH	709.38	.030	774.98	.037	827.08	.035	853.68	.045	884.18	
X1	7	78	0.00	884.18	346.56	389.78	406.33			
GR	3388.9	0.00	3387.66	6.79	3376.24	20.30	3371.25	30.28	3372.42	44.48
GR	3371.5	48.21	3371.02	50.90	3370.32	60.50	3370.52	69.60	3368.62	89.20
GR	3368.5	127.00	3369.02	149.80	3369.32	174.10	3369.52	188.90	3370.42	205.50
GR	3371.4	210.10	3372.02	212.20	3372.92	218.20	3374.52	234.70	3374.32	251.10
GR	3374.2	263.20	3372.32	267.50	3370.72	271.30	3370.52	276.30	3369.82	283.90
GR	3369.1	293.90	3370.52	300.50	3373.62	308.10	3375.02	316.90	3375.72	320.10
GR	3378.8	323.30	3379.72	333.20	3379.72	349.60	3378.82	362.60	3377.02	365.70
GR	3376.5	367.30	3376.52	375.70	3377.12	382.20	3377.92	398.70	3377.72	415.10
GR	3378.8	431.60	3379.20	448.00	3378.40	464.60	3378.10	480.80	3378.60	489.80
GR	3380.1	497.30	3379.90	513.70	3380.40	529.90	3381.20	546.20	3382.18	562.38
GR	3382.4	578.68	3380.58	587.08	3379.88	594.98	3379.38	611.48	3378.08	627.78
GR	3376.8	644.08	3376.98	649.88	3377.68	660.38	3376.68	673.18	3376.38	676.68
GR	3376.2	693.18	3375.38	709.38	3372.38	710.88	3371.48	716.78	3372.28	725.48
GR	3372.1	741.88	3371.18	758.28	3372.88	774.98	3374.48	791.28	3374.08	807.68
GR	3373.0	823.58	3373.08	827.08	3369.98	840.28	3370.28	846.58	3376.58	853.68
GR	3377.7	856.88	3385.18	873.18	3394.68	884.18				

Figure 40. Continued.

NH	8	.056	29.43	.035	155.67	.04	248.06	.031	292.48	.045
NH	619.48	.053	766.48	.030	827.28	.045	847.95			
X1	8	84	0.00	847.95	66.90	91.78	93.19			
GR	3382.9	0.00	3379.38	8.00	3371.59	17.32	3370.18	20.93	3369.41	24.48
GR	3370.0	29.43	3367.71	31.36	3366.43	33.40	3365.46	35.40	3364.34	39.40
GR	3365.7	45.40	3367.47	50.40	3368.39	55.40	3369.22	64.69	3369.04	89.73
GR	3369.1	103.96	3369.17	120.40	3369.81	139.50	3371.57	152.39	3372.99	155.67
GR	3372.9	163.00	3373.60	166.25	3373.61	179.35	3374.25	195.58	3375.01	199.95
GR	3375.2	212.00	3375.00	228.40	3374.48	244.80	3374.37	248.06	3372.97	252.84
GR	3372.0	257.45	3371.56	260.96	3370.56	270.40	3369.93	277.40	3370.57	284.04
GR	3375.3	292.48	3380.98	300.47	3381.48	308.94	3379.81	325.37	3379.92	341.73
GR	3380.2	358.11	3378.59	374.23	3379.43	390.63	3378.35	406.83	3379.30	423.09
GR	3379.4	439.42	3378.66	455.50	3379.50	472.04	3381.90	488.24	3381.81	504.70
GR	3379.7	521.00	3381.77	537.20	3382.57	553.70	3383.17	570.20	3385.67	586.60
GR	3382.4	603.18	3382.46	609.98	3376.86	619.48	3375.66	635.98	3374.06	640.78
GR	3374.8	649.18	3376.06	652.18	3376.36	668.88	3377.76	685.08	3377.36	690.98
GR	3379.4	699.18	3378.46	701.28	3376.42	710.88	3373.62	716.08	3373.72	717.58
GR	3376.0	726.68	3375.72	733.98	3377.32	750.58	3377.82	766.48	3372.06	779.28
GR	3371.7	783.08	3370.96	799.18	3368.66	813.38	3368.96	816.08	3370.96	823.48
GR	3371.4	826.38	3375.47	827.28	3378.71	833.78	3389.95	847.95		
NH	8	.045	12.9	.035	129.6	.030	207.8	.028	310.3	.035
NH	359.5	.056	704.62	.030	799.72	.045	820.12			
X1	9	74	0.00	820.12	838.19	815.71	836.10			
GR	3382.9	0.00	3382.03	6.70	3374.39	12.90	3373.69	14.70	3371.99	19.40
GR	3371.1	26.00	3370.39	34.60	3369.89	43.40	3369.49	46.50	3369.69	53.60
GR	3369.9	62.00	3369.99	65.60	3370.19	76.80	3370.09	92.50	3370.09	99.90
GR	3370.2	110.30	3371.19	115.80	3373.69	121.40	3378.19	129.60	3377.39	147.60
GR	3379.2	152.20	3378.89	162.60	3377.79	179.00	3376.29	195.50	3376.09	202.30
GR	3374.3	207.80	3374.49	211.90	3374.89	228.50	3375.19	244.90	3375.39	261.20
GR	3375.1	277.60	3374.69	294.00	3374.49	310.30	3373.89	327.20	3374.59	343.10
GR	3376.3	359.50	3377.49	368.60	3377.79	375.90	3378.32	392.32	3379.62	408.72
GR	3381.2	420.42	3381.42	425.02	3379.72	436.92	3379.72	441.52	3380.12	457.72
GR	3379.5	474.02	3382.12	490.82	3380.42	507.62	3380.42	524.22	3380.82	534.12
GR	3379.1	540.12	3379.69	556.72	3380.39	572.92	3380.69	589.42	3380.69	605.62
GR	3379.7	622.12	3380.01	638.72	3380.61	655.12	3380.81	671.62	3380.71	688.22
GR	3380.7	704.62	3379.71	720.92	3379.41	737.52	3377.81	741.62	3376.01	742.22
GR	3375.4	744.82	3375.01	754.02	3374.41	770.42	3373.91	786.82	3372.81	798.42
GR	3378.0	799.72	3380.21	803.92	3381.81	810.22	3387.41	820.12		
NH	5	.045	18.1	.035	86.3	.031	155.4	.040	296.11	.045
NH	324.98									
X1	10	38	0.00	324.98	1030.17	1146.52	1153.02			
GR	3385.2	0.00	3382.66	8.30	3380.26	9.20	3379.36	12.70	3377.06	18.10
GR	3375.2	37.40	3374.16	45.00	3373.56	53.40	3373.86	58.50	3373.76	61.10
GR	3374.3	66.00	3374.86	70.30	3375.26	75.30	3375.56	77.80	3376.36	81.40
GR	3377.1	86.30	3379.16	90.00	3378.96	109.20	3378.16	125.40	3377.76	142.80
GR	3377.8	155.40	3377.16	159.80	3376.16	165.70	3375.66	179.70	3375.36	189.80
GR	3375.3	206.40	3375.06	224.30	3375.06	233.50	3375.36	247.10	3376.16	254.90
GR	3375.8	269.00	3375.96	275.60	3375.26	282.10	3376.36	289.40	3376.56	293.60
GR	3377.5	296.11	3380.06	303.50	3395.46	324.98				

Figure 40. Continued.

```
    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*PROF 1

IHLEQ = 1.  THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH.  SEE DOCUMENTATION FOR
DETAILS.

CCHV=      .100 CEHV=       .300
1490 NH CARD USED
*SECNO 1.000

3265 DIVIDED FLOW

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3371.80 ELREA=      3365.37

     1.000      3.06   3358.91       .00   3358.91   3359.01       .11       .00       .00   3371.80
    1205.0        .0    1205.0        .0        .0     452.8        .0        .0        .0   3365.37
       .00       .00      2.66       .00      .000      .028      .000      .000   3355.84     26.19
   .000866        0.        0.        0.         0         0         0       .00    197.81    362.94


1490 NH CARD USED
*SECNO 2.000

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =    .70

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3373.10 ELREA=      3364.18

     2.000      4.42   3359.55       .00       .00   3359.70       .15       .68       .01   3373.10
    1205.0        .0    1205.0        .0        .0     382.5        .0       5.2       2.5   3364.18
       .05       .00      3.15       .00      .000      .031      .000      .000   3355.13     21.54
   .001779      544.      544.      550.         3         0         0       .00    196.05    217.58


1490 NH CARD USED
*SECNO 3.000

3265 DIVIDED FLOW

    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST
3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3375.70 ELREA=      3369.77
```

Figure 40. Continued.

3.000	4.53	3361.03	.00	.00	3361.22	.18	1.50	.01	3375.70
1205.0	.0	1205.0	.0	.0	350.8	.0	12.4	6.0	3369.77
.12	.00	3.44	.00	.000	.029	.000	.000	3356.50	23.43
.001730	867.	857.	545.	3	0	0	.00	165.46	331.32

1490 NH CARD USED
*SECNO 4.000

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .45

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 3376.30 ELREA= 3370.72

4.000	4.21	3362.74	.00	.00	3363.11	.36	1.84	.05	3376.30
1205.0	.0	1205.0	.0	.0	249.4	.0	15.7	8.1	3370.72
.14	.00	4.83	.00	.000	.030	.000	.000	3358.53	23.57
.008589	483.	477.	183.	3	0	0	.00	223.97	342.68

1490 NH CARD USED
*SECNO 5.000

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.45

5.000	4.58	3369.05	.00	.00	3369.20	.15	6.07	.02	3384.30
1205.0	.0	1205.0	.0	.0	389.7	.0	33.9	19.7	3379.90
.37	.00	3.09	.00	.000	.030	.000	.000	3364.47	189.04
.001428	2484.	2479.	2306.	7	0	0	.00	182.68	388.81

1490 NH CARD USED
*SECNO 6.000

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3265 DIVIDED FLOW

6.000	6.61	3369.89	.00	.00	3370.03	.13	.82	.00	3388.00
1205.0	.0	1205.0	.0	.0	413.6	.0	39.3	22.7	3388.28
.42	.00	2.91	.00	.000	.026	.000	.000	3363.28	156.30
.001379	531.	587.	617.	3	0	0	.00	256.52	460.71

Figure 40. Continued.

```
1490 NH CARD USED
*SECNO 7.000

3265 DIVIDED FLOW

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .55

     7.000      2.51   3371.01       .00       .00   3371.25       .24      1.19       .03   3388.90
    1205.0        .0    1205.0        .0        .0     307.6        .0      42.7      24.8   3394.68
       .45       .00      3.92       .00      .000      .034      .000      .000   3368.50     51.02
   .004489      347.      406.      390.         5         0         0       .00    199.87    847.40

1490 NH CARD USED
*SECNO 8.000

3265 DIVIDED FLOW

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.62

     8.000      7.01   3371.35       .00       .00   3371.49       .14       .23       .01   3382.90
    1205.0        .0    1205.0        .0        .0     395.5        .0      43.4      25.2   3389.95
       .46       .00      3.05       .00      .000      .032      .000      .000   3364.34     17.95
   .001707       67.       93.       92.         2         0         0       .00    190.44    826.02

1490 NH CARD USED
*SECNO 9.000

3265 DIVIDED FLOW

     9.000      3.60   3373.09       .00       .00   3373.37       .28      1.84       .04   3382.90
    1205.0        .0    1205.0        .0        .0     282.6        .0      49.9      28.1   3387.41
       .52       .00      4.26       .00      .000      .034      .000      .000   3369.49     16.36
   .002689      838.      836.      816.         3         0         0       .00    106.70    798.49

    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

1490 NH CARD USED
*SECNO 10.000

3265 DIVIDED FLOW

    10.000      3.54   3377.10       .00       .00   3377.30       .20      3.92       .01   3385.20
    1205.0        .0    1205.0        .0        .0     336.2        .0      58.1      32.2   3395.46
       .60       .00      3.58       .00      .000      .037      .000      .000   3373.56     18.01
   .004116     1030.     1153.     1147.         9         0         0       .00    203.17    295.04
```

Figure 40. Continued.

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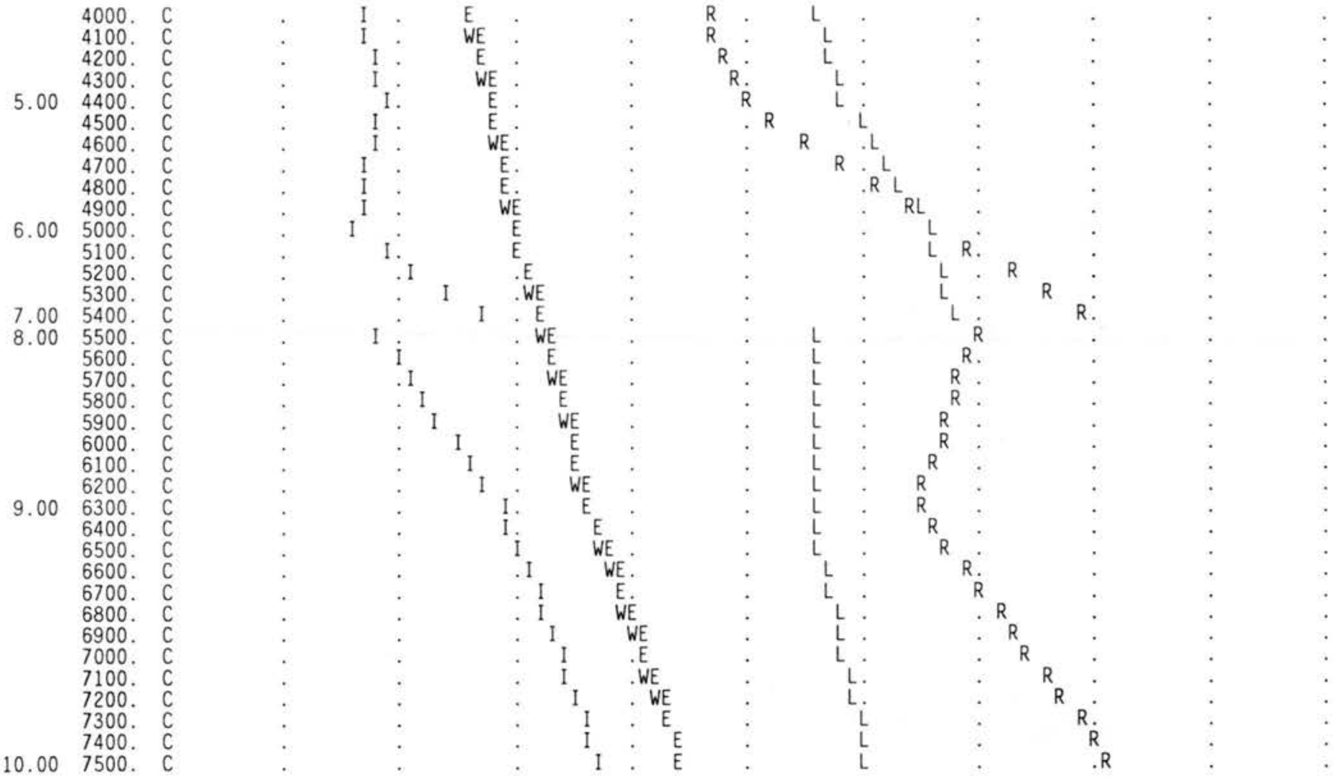
PROFILE FOR STREAM  MF FLATHEAD RIVER

PLOTTED POINTS (BY PRIORITY) E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

ELEVATION  3355.     3360.     3365.     3370.     3375.     3380.     3385.     3390.     3395.     3400.
    SECNO   CUMDIS

     1.00      0.  CI      E .         R         .  L      .         .         .         .         .         .         .
             100.  CI      E .         R         .   L     .         .         .         .         .         .         .
             200.  CI      E .         R         .   L     .         .         .         .         .         .         .
             300.  CI      WE.        R.         .   ML    .         .         .         .         .         .         .
             400.  I       WE.        R.         .    L    .         .         .         .         .         .         .
             500.  I        E.       R .         .    ML   .         .         .         .         .         .         .
     2.00    600.  I        E.       R .         .    ML   .         .         .         .         .         .         .
             700.  I        E.        R.         .     ML  .         .         .         .         .         .         .
             800.  CI        E         .R        .     ML  .         .         .         .         .         .         .
             900.  CI        E         . R       .      ML .         .         .         .         .         .         .
            1000.  CI        WE        .  R      .       L .         .         .         .         .         .         .
            1100.  C I       .E        .    R    .        L.         .         .         .         .         .         .
            1200.  C I       .E        .     R   .        ML         .         .         .         .         .         .
            1300.  C I       .WE       .      R  .         L         .         .         .         .         .         .
            1400.  C  I      . E       .        R.         .L        .         .         .         .         .         .
     3.00   1500.  C  I      . E       .        R.         .L        .         .         .         .         .         .
            1600.  C   I     .  E      .         R         .L        .         .         .         .         .         .
            1700.  C   I     .  WE     .         R         . L       .         .         .         .         .         .
            1800.  C    I    .   WE    .         R         . L       .         .         .         .         .         .
     4.00   1900.  C      I  .    WE   .         .R        . L       .         .         .         .         .         .
            2000.  C      I  .     E   .         . R       .  L      .         .         .         .         .         .
            2100.  C       I .     WE  .         .  R      .   L     .         .         .         .         .         .
            2200.  C       I .      E  .         .  R      .   L     .         .         .         .         .         .
            2300.  C        I.      WE .         .   R     .    L    .         .         .         .         .         .
            2400.  C        I.       E .         .    R    .     L   .         .         .         .         .         .
            2500.  C         I       WE.         .     R   .     L   .         .         .         .         .         .
            2600.  C         I        E.         .     R   .      L  .         .         .         .         .         .
            2700.  C         .I       WE         .      R  .       L .         .         .         .         .         .
            2800.  C         .I        E         .       R .       L .         .         .         .         .         .
            2900.  C         . I       WE        .        R.        L.         .         .         .         .         .
            3000.  C         . I       .E        .        R.        L.         .         .         .         .         .
            3100.  C         .  I      .WE       .         R         L         .         .         .         .         .
            3200.  C         .  I      . E       .         .R        .L        .         .         .         .         .
            3300.  C         .   I     . WE      .         . R       .L        .         .         .         .         .
            3400.  C         .   I     .  E      .         . R       . L       .         .         .         .         .
            3500.  C         .   I     .  WE     .         .  R      .  L      .         .         .         .         .
            3600.  C         .    I    .   E     .         .   R     .  L      .         .         .         .         .
            3700.  C         .    I    .   WE    .         .    R    .   L     .         .         .         .         .
            3800.  C         .     I   .    E    .         .    R    .    L    .         .         .         .         .
            3900.  C         .     I   .    WE   .         .     R   .    L    .         .         .         .         .
```

Figure 40. Continued.



```
T1  GLACIER NATIONAL PARK
T2  SECOND PROFILE
T3       MF FLATHEAD RIVER
J1  ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
                 3           0          0          0          0          0                3363.24
J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
      2
```

Figure 40. Continued.

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*PROF 2

IHLEQ = 1.  THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH.  SEE DOCUMENTATION FOR
DETAILS.

CCHV=      .100 CEHV=      .300
1490 NH CARD USED
*SECNO 1.000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3371.80 ELREA=      3365.37

     1.000      7.40   3363.24       .00   3363.24   3364.10       .86       .00       .00   3371.80
   13200.0        .0   13200.0        .0        .0    1769.3        .0        .0        .0   3365.37
       .00       .00      7.46       .00      .000      .028      .000      .000   3355.84     17.85
   .002348        0.        0.        0.         0         0         0       .00    348.91    366.76

1490 NH CARD USED
*SECNO 2.000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3373.10 ELREA=      3364.18

     2.000      9.39   3364.52       .00       .00   3365.42       .90      1.30       .01   3373.10
   13200.0        .0   11859.7    1340.3        .0    1500.2     342.5      22.6       5.0   3364.18
       .02       .00      7.91      3.91      .000      .025      .055      .000   3355.13     15.02
   .002431      544.      544.      550.         0         0         0       .00    446.42    461.44

1490 NH CARD USED
*SECNO 3.000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3375.70 ELREA=      3369.77

     3.000      9.99   3366.49       .00       .00   3367.33       .84      1.91       .01   3375.70
   13200.0        .0   13200.0        .0        .0    1798.7        .0      57.2      12.9   3369.77
       .05       .00      7.34       .00      .000      .025      .000      .000   3356.50     16.52
   .002123      867.      857.      545.         2         0         0       .00    399.65    416.17
```

Figure 40. Continued.

```
1490 NH CARD USED

     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO 4.000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      3376.30 ELREA=     3370.72

     4.000       9.08    3367.61        .00        .00    3368.41        .81       1.08        .00    3376.30
   13200.0         .0    13200.0         .0         .0     1830.6         .0       77.0       17.2    3370.72
       .07        .00       7.21        .00       .000       .029       .000       .000    3358.53      15.97
   .002420       483.       477.       183.          3          0          0        .00     377.13     393.10

1490 NH CARD USED
*SECNO 5.000
     5.000       9.39    3373.86        .00        .00    3375.13       1.26       6.58        .14    3384.30
   13200.0         .0    13200.0         .0         .0     1464.9         .0      170.8       35.9    3379.90
       .15        .00       9.01        .00       .000       .027       .000       .000    3364.47     117.31
   .002908      2484.      2479.      2306.          3          0          0        .00     279.64     396.95

1490 NH CARD USED
*SECNO 6.000

3301 HV CHANGED MORE THAN HVINS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.51

     6.000      12.59    3375.87        .00        .00    3376.25        .38       1.04        .09    3388.00
   13200.0         .0    13200.0         .0         .0     2665.1         .0      198.6       40.8    3388.28
       .18        .00       4.95        .00       .000       .035       .000       .000    3363.28      20.15
   .001268       531.       587.       617.          2          0          0        .00     447.73     467.89

1490 NH CARD USED
*SECNO 7.000

3265 DIVIDED FLOW

     7.000       7.92    3376.42        .00        .00    3376.96        .54        .66        .05    3388.90
   13200.0         .0    13200.0         .0         .0     2229.0         .0      221.5       45.1    3394.68
       .20        .00       5.92        .00       .000       .031       .000       .000    3368.50      20.09
   .001995       347.       406.       390.          2          0          0        .00     477.98     853.50
```

Figure 40. Continued.

```
     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

1490 NH CARD USED
*SECNO 8.000

3265 DIVIDED FLOW

     8.000      12.12    3376.46        .00        .00    3377.26        .80        .22        .08    3382.90
   13200.0         .0    13200.0         .0         .0     1839.4         .0      225.8       46.0    3389.95
       .20        .00       7.18        .00       .000       .029       .000       .000    3364.34      11.49
   .002828        67.        93.        92.          2          0          0        .00     418.46     829.27

1490 NH CARD USED
*SECNO 9.000

3265 DIVIDED FLOW

     9.000       9.26    3378.75        .00        .00    3379.51        .75       2.24        .00    3382.90
   13200.0         .0    13200.0         .0         .0     1897.8         .0      261.7       54.2    3387.41
       .24        .00       6.96        .00       .000       .028       .000       .000    3369.49       9.36
   .002546       838.       836.       816.          2          0          0        .00     436.55     801.14

1490 NH CARD USED
*SECNO 10.000
    10.000       8.55    3382.11        .00        .00    3383.05        .94       3.49        .06    3385.20
   13200.0         .0    13200.0         .0         .0     1697.2         .0      309.3       64.0    3395.46
       .28        .00       7.78        .00       .000       .036       .000       .000    3373.56       8.50
   .003507      1030.      1153.      1147.          2          0          0        .00     297.86     306.36

PROFILE FOR STREAM  MF FLATHEAD RIVER

PLOTTED POINTS (BY PRIORITY) E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

ELEVATION  3355.      3360.      3365.      3370.      3375.      3380.      3385.      3390.      3395.      3400.
   SECNO    CUMDIS

    1.00       0.  CI         .      W E R        .  L       .          .          .          .          .          .          .
             100.  CI         .      WE R         .   L      .          .          .          .          .          .          .
             200.  CI         .      W ER         .   L      .          .          .          .          .          .          .
             300.  CI         .       WE.         .   ML     .          .          .          .          .          .          .
             400.  I          .       WRE         .    L     .          .          .          .          .          .          .
             500.  I          .       RWE         .    ML    .          .          .          .          .          .          .
```

Figure 40. Continued.

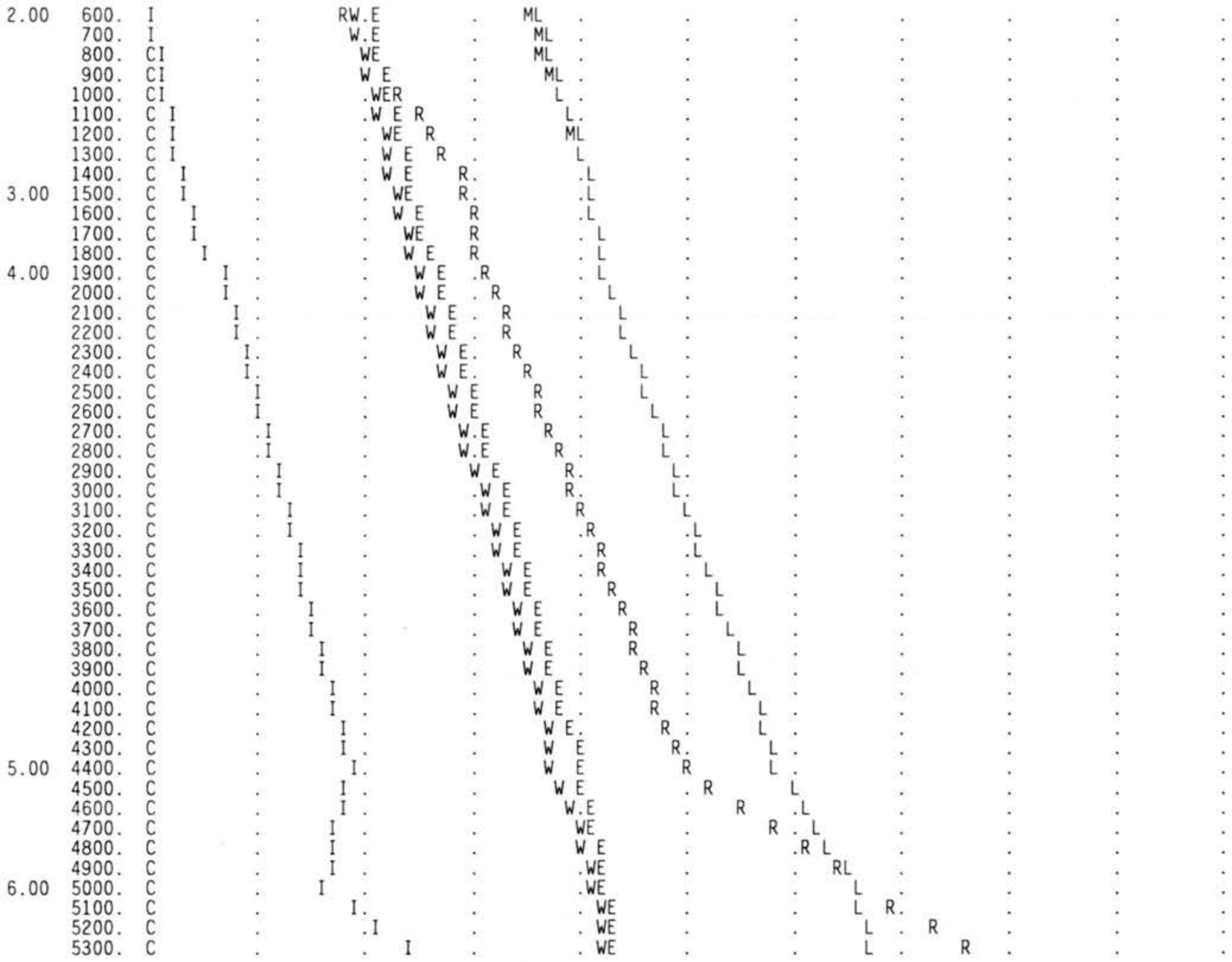


Figure 40. Continued.

```
 7.00  5400.  C          .         .        I  .         .  WE     .         .       L .        R.         .
 8.00  5500.  C          .       I .         .         .  WE     .     L   .         R         .         .         .
       5600.  C          .         I         .         .  W E    .     L   .        R.         .         .         .
       5700.  C          .         .I        .         .   WE    .     L   .       R .         .         .         .
       5800.  C          .         . I       .         .   W E   .     L   .       R .         .         .         .
       5900.  C          .         .  I      .         .    WE   .     L   .      R  .         .         .         .
       6000.  C          .         .    I    .         .    W E  .     L   .      R  .         .         .         .
       6100.  C          .         .     I   .         .     WE  .     L   .     R   .         .         .         .
       6200.  C          .         .      I  .         .     W E .     L   .    R    .         .         .         .
 9.00  6300.  C          .         .        I.         .      W E.     L   .    R    .         .         .         .
       6400.  C          .         .        I.         .       WE.     L   .     R   .         .         .         .
       6500.  C          .         .         I         .       W E     L   .      R  .         .         .         .
       6600.  C          .         .         .I        .        W.E     L  .        R.         .         .         .
       6700.  C          .         .         . I       .         WE     L  .         R         .         .         .
       6800.  C          .         .         . I       .         W E     L .         . R       .         .         .
       6900.  C          .         .         .  I      .         .WE     L .         .  R      .         .         .
       7000.  C          .         .         .   I     .         .W E    L .         .   R     .         .         .
       7100.  C          .         .         .   I     .         . W E    L.         .     R   .         .         .
       7200.  C          .         .         .    I    .         . W E    L.         .      R  .         .         .
       7300.  C          .         .         .     I   .         .  W E    L         .        R.         .         .
       7400.  C          .         .         .     I   .         .   W E   L         .         R         .         .
10.00  7500.  C          .         .         .      I  .         .   W E   L         .         .R        .         .
```

THIS RUN EXECUTED 01OCT91   05:21:32

```
*************************************
 HEC-2 WATER SURFACE PROFILES
 Version   4.5.1;  September 1990
*************************************
```

MF FLATHEAD RIVER
SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	3355.84	1205.00	3358.91	.00	3359.01	8.66	2.66	452.82	409.57
	1.000	.00	.00	.00	3355.84	13200.00	3363.24	.00	3364.10	23.48	7.46	1769.31	2723.83
*	2.000	544.28	.00	.00	3355.13	1205.00	3359.55	.00	3359.70	17.79	3.15	382.50	285.70
	2.000	544.28	.00	.00	3355.13	13200.00	3364.52	.00	3365.42	24.31	7.91	1842.68	2677.25
	3.000	856.79	.00	.00	3356.50	1205.00	3361.03	.00	3361.22	17.30	3.44	350.77	289.71
	3.000	856.79	.00	.00	3356.50	13200.00	3366.49	.00	3367.33	21.23	7.34	1798.73	2864.94
*	4.000	476.88	.00	.00	3358.53	1205.00	3362.74	.00	3363.11	85.89	4.83	249.40	130.02
	4.000	476.88	.00	.00	3358.53	13200.00	3367.61	.00	3368.41	24.20	7.21	1830.57	2683.31
*	5.000	2478.78	.00	.00	3364.47	1205.00	3369.05	.00	3369.20	14.28	3.09	389.69	318.87
	5.000	2478.78	.00	.00	3364.47	13200.00	3373.86	.00	3375.13	29.08	9.01	1464.93	2447.66

Figure 40. Continued.

	6.000	587.29	.00	.00	3363.28	1205.00	3369.89	.00	3370.03	13.79	2.91	413.62	324.44
*	6.000	587.29	.00	.00	3363.28	13200.00	3375.87	.00	3376.25	12.68	4.95	2665.06	3706.82
*	7.000	406.33	.00	.00	3368.50	1205.00	3371.01	.00	3371.25	44.89	3.92	307.63	179.85
	7.000	406.33	.00	.00	3368.50	13200.00	3376.42	.00	3376.96	19.95	5.92	2228.99	2955.45
*	8.000	93.19	.00	.00	3364.34	1205.00	3371.35	.00	3371.49	17.07	3.05	395.52	291.66
	8.000	93.19	.00	.00	3364.34	13200.00	3376.46	.00	3377.26	28.28	7.18	1839.38	2481.99
	9.000	836.10	.00	.00	3369.49	1205.00	3373.09	.00	3373.37	26.89	4.26	282.62	232.39
	9.000	836.10	.00	.00	3369.49	13200.00	3378.75	.00	3379.51	25.46	6.96	1897.83	2615.84
	10.000	1153.02	.00	.00	3373.56	1205.00	3377.10	.00	3377.30	41.16	3.58	336.23	187.83
	10.000	1153.02	.00	.00	3373.56	13200.00	3382.11	.00	3383.05	35.07	7.78	1697.21	2229.12

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	1205.00	3358.91	.00	.00	.00	197.81	.00
	1.000	13200.00	3363.24	4.33	.00	.00	348.91	.00
*	2.000	1205.00	3359.55	.00	.64	.00	196.05	544.28
	2.000	13200.00	3364.52	4.97	1.28	.00	446.42	544.28
	3.000	1205.00	3361.03	.00	1.48	.00	165.46	856.79
	3.000	13200.00	3366.49	5.46	1.97	.00	399.65	856.79
*	4.000	1205.00	3362.74	.00	1.71	.00	223.97	476.88
	4.000	13200.00	3367.61	4.86	1.11	.00	377.13	476.88
*	5.000	1205.00	3369.05	.00	6.31	.00	182.68	2478.78
	5.000	13200.00	3373.86	4.81	6.26	.00	279.64	2478.78
	6.000	1205.00	3369.89	.00	.84	.00	256.52	587.29
*	6.000	13200.00	3375.87	5.98	2.01	.00	447.73	587.29
*	7.000	1205.00	3371.01	.00	1.12	.00	199.87	406.33
	7.000	13200.00	3376.42	5.41	.55	.00	477.98	406.33
*	8.000	1205.00	3371.35	.00	.33	.00	190.44	93.19
	8.000	13200.00	3376.46	5.12	.04	.00	418.46	93.19
	9.000	1205.00	3373.09	.00	1.74	.00	106.70	836.10
	9.000	13200.00	3378.75	5.67	2.29	.00	436.55	836.10
	10.000	1205.00	3377.10	.00	4.01	.00	203.17	1153.02
	10.000	13200.00	3382.11	5.01	3.36	.00	297.86	1153.02

Figure 40. Continued.

SUMMARY OF ERRORS AND SPECIAL NOTES

```
WARNING SECNO=      2.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      6.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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Figure 40. Continued.

APPENDIX C

USGS FLOW DATA AND NPS DISCHARGE MEASUREMENTS

Station	M F FLATHEAD RIVER NEAR WEST GLACIER, MT.			Id	12358500
Parameter	Streamflow (cfs)			Statistic	Mean
Year	1940-1989	Drainage Area	1128	Hydrolog Unit	17010207
Site Code	Stream	Contribute Area	0.00	Geologic Unit	
State	MT	Gage Datum	3128.70	Aquifer Type	?????
County	029	Well Depth	No value	Agency	USGS
Latitude	48:29:43	Sample XSection	No value	Agency Office	MT
Longitude	114:00:33	Sample Depth	No value	Sequence#	00

50	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Cnt	1550	1500	1550	1550	1413	1550	1500	1550	1500	1550	1550	1498	18261
D Avg	1067	1032	882	695	681	810	3123	9747	10213	3938	1353	981	2883
D Max	6280	7640	8610	8920	6880	6480	17500	32000	92700	15300	3540	6870	92700
D Min	324	189	205	210	232	270	300	1070	1820	815	432	343	189
M Cnt	50	50	50	50	50	50	50	50	50	50	50	49	49
M Std	690	600	547	391	414	482	1364	2282	3942	1782	427	443	636
M Skw	1.5	1.1	1.6	2.4	2.8	2.6	0.41	0.17	0.52	0.48	0.40	1.9	-0.43
M Max	3004	3131	2596	2420	2686	2779	7093	14668	19869	8162	2364	2510	4071
M Min	367	279	262	316	300	307	664	5259	3576	1249	576	420	1437

Coverage : 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

Station	MIDDLE FORK FLATHEAD RIVER AT ESSEX, MT.			Id	12357000
Parameter	Streamflow (cfs)			Statistic	Mean
Year	1940-1964	Drainage Area	510	Hydrolog Unit	17010207
Site Code	Stream	Contribute Area	0.00	Geologic Unit	
State	MT	Gage Datum	3721.93	Aquifer Type	?????
County	029	Well Depth	No value	Agency	USGS
Latitude	48:16:30	Sample XSection	No value	Agency Office	MT
Longitude	113:36:10	Sample Depth	No value	Sequence#	00

23	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Cnt	682	660	682	682	622	682	660	682	690	713	713	690	8158
D Avg	347	355	333	223	237	251	1322	4352	3795	1041	326	244	1075
D Max	2200	2030	2260	895	1420	1620	7890	13600	37000	7020	828	843	37000
D Min	124	50	60	30	70	60	149	672	465	227	127	111	30
M Cnt	22	22	22	22	22	22	22	22	23	23	23	23	22
M Std	237	223	224	103	133	98	656	1115	1926	628	103	71	300
M Skw	1.7	0.97	1.1	1.4	1.6	0.73	0.63	-0.09	0.63	1.2	0.63	1.8	-0.25
M Max	1079	812	884	489	602	490	2851	6720	7537	2591	557	427	1577
M Min	137	108	103	93	100	127	389	1973	1001	309	164	148	465

Coverage : 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

Figure 41. Summary streamflow data for the Middle Fork Flathead River at West Glacier and Essex, Montana (US West 1988).

12358500 M F FLATHEAD RIVER NEAR WEST GLACIER, MT.
LOCATION.--Lat 48:29:43, Long 114:00:33, Hydrologic Unit 17010207.
DRAINAGE AREA.-- 1128.00 mi2 (2921.52 km2).
PERIOD OF RECORD.-- 1940-1989
GAGE.-- Altitude of gage is 3128.70 ft(954 m).

STREAMFLOW (CFS), WATER YEAR OCT 1939 TO SEP 1940
MEAN

DAY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	400	354	354	566	320	492	1600	3740	8900	2040	840	432
2	400	354	330	552	320	492	1630	3970	8040	2040	840	420
3	400	354	330	538	320	524	1700	6760	7710	1970	804	420
4	400	354	325	524	320	510	1580	8040	7060	1970	768	432
5	400	354	320	498	320	498	1500	7060	6740	1900	732	438
6	380	342	330	486	342	486	1470	6120	6280	1830	750	504
7	380	354	330	474	354	462	1470	5250	5680	1830	696	468
8	380	426	336	450	342	474	1550	4850	5530	1630	678	444
9	380	426	438	320	342	462	1830	5120	5120	1550	660	444
10	380	414	504	420	378	438	2040	7380	4980	1500	644	438
11	380	408	580	384	372	426	1900	10500	5250	1470	580	432
12	380	402	628	380	354	408	1900	12400	5820	1400	612	438
13	348	396	612	402	342	402	1830	10900	5970	1420	596	420
14	348	390	596	402	330	396	2190	9810	5970	1370	580	432
15	354	390	644	408	330	414	3150	8720	5250	1320	552	795
16	354	384	786	414	330	462	3630	8380	4720	1270	538	687
17	354	378	900	426	320	596	3200	8040	4460	1270	524	620
18	348	378	960	300	320	660	3090	7380	4210	1230	510	573
19	360	366	880	280	315	696	3740	7710	3970	1180	498	573
20	360	366	840	264	310	696	4210	9070	4090	1140	498	559
21	360	354	840	232	310	768	5390	9070	4090	1120	486	588
22	348	366	786	260	280	840	5250	8900	3630	1080	486	1070
23	336	354	696	285	280	960	4720	9420	3300	1040	486	1130
24	342	354	596	310	264	1080	4460	9780	2890	1000	480	990
25	342	330	580	315	320	1140	3970	10500	2800	980	474	930
26	342	300	596	320	330	1180	3740	10500	2800	920	462	831
27	342	305	531	330	320	1270	3740	9070	2610	960	450	777
28	366	320	426	336	354	1400	3970	8040	2350	1080	474	723
29	378	325	510	342	474	1400	4090	7710	2190	1000	456	669
30	378	330	596	354	---	1470	3970	8040	2120	940	444	636
31	366	---	580	330	---	1550	---	8720	---	900	432	---
Total	11386	10928	17760	11902	9613	23052	88510	250950	144530	42350	18030	18313
Mean	367	364	573	384	331	744	2950	8095	4818	1366	582	610
Max	400	426	960	566	474	1550	5390	12400	8900	2040	840	1130
Min	336	300	320	232	264	396	1470	3740	2120	900	432	420
Ac-Ft	22584	21675	35226	23607	19067	45723	175557	497752	286671	84000	35762	36323

WTR YR 1940 TOTAL 647324 MEAN 1769 MAX 12400 MIN 232 AC-FT 1283948

12357000 MIDDLE FORK FLATHEAD RIVER AT ESSEX, MT.
LOCATION.--Lat 48:16:30, Long 113:36:10, Hydrologic Unit 17010207.
DRAINAGE AREA.-- 510.00 mi2 (1320.90 km2).
PERIOD OF RECORD.-- 1940-1964
GAGE.-- Altitude of gage is 3721.93 ft(1134 m).

STREAMFLOW (CFS), WATER YEAR OCT 1939 TO SEP 1940
MEAN

DAY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	150	145	121	155	90	156	440	1420	2750	460	227	121
2	150	134	119	150	80	156	455	2120	2600	450	227	116
3	150	140	124	145	75	150	445	3410	2390	421	218	121
4	150	140	116	140	80	142	412	3500	2120	416	208	127
5	150	140	114	130	90	140	403	2820	1940	408	202	134
6	140	132	121	120	110	134	408	2320	1830	403	196	132
7	140	145	119	110	105	129	426	2000	1670	377	190	127
8	140	161	124	105	110	134	480	1940	1620	356	187	121
9	140	150	156	50	103	129	614	2320	1520	344	178	116
10	140	145	167	100	114	124	650	3410	1470	340	172	116
11	140	142	199	95	106	111	568	5080	1520	325	167	116
12	140	145	196	95	103	116	562	5080	1520	314	164	111
13	130	142	172	120	101	114	602	4320	1520	303	161	116
14	130	140	178	125	101	119	1160	3750	1380	296	158	175
15	130	140	205	130	98	127	1620	3410	1240	289	156	187
16	130	137	246	130	98	172	1380	3320	1120	282	156	158
17	130	132	282	115	96	227	1200	3060	1040	292	153	145
18	130	127	266	70	96	230	1280	2820	955	282	153	137
19	130	127	234	60	98	221	1720	3060	895	269	150	145
20	130	127	218	50	98	218	2000	3700	902	259	147	142
21	130	119	214	40	98	230	2120	3500	836	256	145	153
22	130	124	196	30	93	269	1830	3410	767	253	145	234
23	130	127	170	35	91	310	1720	3600	715	243	142	230
24	130	116	145	45	80	352	1570	3800	638	237	142	202
25	130	106	120	55	100	377	1420	4000	608	237	140	187
26	130	103	100	60	110	373	1380	3800	579	237	134	172
27	130	96	90	70	100	381	1420	3140	552	253	134	161
28	130	98	130	80	120	394	1570	2680	524	259	140	153
29	150	108	170	90	150	390	1620	2600	491	250	134	147
30	150	119	165	100	---	394	1470	2750	465	240	129	145
31	145	---	160	95	---	430	---	2980	---	227	127	---
Total	4255	3907	5137	2895	2894	6949	32945	99120	38177	9578	5082	4447
Mean	137	130	166	93	100	224	1098	3197	1273	309	164	148
Max	150	161	282	155	150	430	2120	5080	2750	460	227	234
Min	130	96	90	30	75	111	403	1420	465	227	127	111
Ac-Ft	8440	7749	10189	5742	5740	13783	65345	196602	75723	18998	10080	8820

WTR YR 1940 TOTAL 215386 MEAN 588 MAX 5080 MIN 30 AC-FT 427212

Figure 42. Examples of mean daily flow data collected at USGS gaging stations on the Middle Fork Flathead River at West Glacier and Essex, Montana (US West 1988).

Table 19. Measured discharge (cfs) and corresponding stage readings (feet above mean sea level) at Nyack study site, Middle Fork Flathead River. Measurements taken at HEC-2 cross-section 1 in 1990, and at cross-section 2 in 1991. A temporary reference point was used on July 15, 1990, therefore no stage elevation was recorded.

Date	Discharge	Stage
July 15, 1990	2273	-
July 23, 1990	1205	3358.91
Sept 1, 1990	565	3358.48
June 5, 1991	13200	3364.42
June 19, 1991	4890	3362.02
July 10, 1991	4277	3361.96
July 17, 1991	3382	3361.46
July 24, 1991	2080	3360.88
July 29, 1991	1692	3360.59
Aug 7, 1991	1193	3360.54
Aug 12, 1991	1262	3360.56
Aug 19, 1991	792	3360.08
Sept 3, 1991	514	3359.67
Sept 9, 1991	518	3359.68
Sept 15, 1991	467	3359.58

APPENDIX D
VEGETATION FIELD DATA

Table 20. Definition of Riparian Survey Form Terms.

Term		Definition
* Rooted Substrate (after Bovee and Milhous 1978)		
Boulder	-	> 250 millimeters (mm)
Cobble	-	64 - 250 mm
Gravel	-	2 - 64 mm
Fines	-	< 2 mm
* Geomorphic Landforms (after Hupp 1988)		
Channel bed	-	active channel, wholly or partially covered by flows < or = to the mean annual flow.
Depositional bar	-	depositional surface within the active channel, often devoid of woody vegetation.
Channel bank	-	contains the active channel, steep sloped, often lower limit of perennial vegetation.
Channel shelf	-	horizontal to gently sloping surface extending between channel banks and floodplain.
Floodplain	-	relatively large, flat surface flooded by flows > bankfull, usually once every 1-3 years.
Terrace	-	remnant floodplain removed from active channel, seldom flooded; not distinguishable in study reach.
Upland	-	typically never flooded; completely removed from active channel; remnant, if any, riparian vegetation.
* Cover Class (after Daubenmire 1959)		
1	-	< 1 % absolute cover
2	-	1 - 5 % absolute cover
3	-	5 - 25 % absolute cover
4	-	25 - 50 % absolute cover
5	-	50 - 75 % absolute cover
6	-	75 - 95 % absolute cover
7	-	> 95 % absolute cover
* Height Class		
0	-	< 10 feet tall
1	-	11 - 20 feet tall
2	-	21 - 30 feet tall
3	-	31 - 40 feet tall
4	-	41 - 50 feet tall
5	-	51 - 60 feet tall
6	-	61 - 70 feet tall
7	-	71 - 80 feet tall
8	-	81 - 90 feet tall
9	-	91 - 100 feet tall
10	-	101 - 110 feet tall
11	-	111 - 120 feet tall
12	-	121 - 130 feet tall
13	-	131 - 140 feet tall
14	-	141 - 150 feet tall

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 — OBSERVER: M. Wondzell
PLOT NUMBER: 0 — DATE: 8-10-90

ELEVATION: 3358.95
DISTANCE: 143.80
ROOTED SUBSTRATE: __ boulder 30 cobble 60 gravel 10 sand __ fines
LANDFORM TYPE: X channel bed __ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS: Active channel - no plants - stake pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE # | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	90
								B.G.	10
								LITTER	0
								MOSS	0
								OTHER	0

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 — OBSERVER: M. Wondzell
PLOT NUMBER: 1 — DATE: 8-10-90

ELEVATION: 3359.36
DISTANCE: 160.20
ROOTED SUBSTRATE: – boulder 5 cobble 85 gravel 10 sand – fines
LANDFORM TYPE: ✓ channel bed __ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS: Active channel - no plants - stake pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE # | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	90
								B.G.	10
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 — OBSERVER: Wondzell
PLOT NUMBER: 2 — DATE: 8-10-90

ELEVATION: 3359.42
DISTANCE: 176.60
ROOTED SUBSTRATE: __ boulder 5 cobble 90 gravel 5 sand __ fines
LANDFORM TYPE: ✓ channel bed __ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS: Active channel - no veg. - stake pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE # | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	95
								B.G.	5
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 — OBSERVER: Wondzell
PLOT NUMBER: 3 — DATE: 8-10-90

ELEVATION: 3359.37
DISTANCE: 193.0
ROOTED SUBSTRATE: – boulder – cobble 95 gravel 5 sand – fines
LANDFORM TYPE: ✓ channel bed __ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS: Active channel - no veg. - stake pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE # | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	95
								B.G.	5
								LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Vegetation data sheets for riparian cross-sections 1-6.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 4 DATE: 8-10-90

ELEVATION: 3359.02
DISTANCE: 209.4
ROOTED SUBSTRATE: - boulder - cobble 100 gravel - sand - fines
LANDFORM TYPE: ✓ channel bed __ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS: Active channel - no veg. - stake pulled

TREE SPECIES	0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	100
								B.G.	-
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 5 DATE: 8-10-90

ELEVATION: 3362.87
DISTANCE: 225.8
ROOTED SUBSTRATE: __ boulder 5 cobble __ gravel 75 sand 20 fines
LANDFORM TYPE: __ channel bed __ depositional bar ✓ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS: Rt bank of main channel - stake is at top of right bank. Some beaver damage to small saplings - large 5-7" diameter 35-40' CW right on bank edge. otherwise mostly 1-3" CW saps ≈ 20' tall

TREE SPECIES	0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	0	1	3		4						

TREE*	DBH	HT	AGE	REMARKS:
				All CW trunks rotten ∴ no age estimate: 25 yrs for large ones + 15 for small

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	:	0.0	1	Somi	3 (15)			ROCK	-
				Ciso	1			B.G.	80
				AsFo	1			LITTER	1
				Arln	1			MOSS	-
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 6 DATE: 8-10-90

ELEVATION: 3363.37
DISTANCE: 242.0
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 40 sand 60 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS: sand [illegible] 6" deep on stream 1/3 of plot - see diagram otherwise mostly fines (i.e. silt)

TREE SPECIES	0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	8	2	3								

TREE*	DBH	HT	AGE	REMARKS:
CW	3.8	35	15	oldest/largest tree in plot - only one of this size
CW	2.4	25	11	Typical of most 1-3" dbh trees in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	·	0.0	3 (10)	Taof	1			ROCK	-
				Gunk-1	1			B.G.	85
				AsFo	1			LITTER	8
				Gunk-3	1			MOSS	-
								OTHER	5 - tree stem

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 7 DATE: 8-10-90

ELEVATION: 3363.79
DISTANCE: 258.60
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel __ sand 100 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS: No shrubs - beaver damage to several CW saps (e.g. 14 1' high stumps) this explains why no dead saps were recorded!

TREE SPECIES	0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	8	2	3								
ES												

TREE*	DBH	HT	AGE	REMARKS:
CW	2.6	25	12	typical of most [illegible] in plot
ES	-	1.7	7	7 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				AsFo	1			ROCK	
NO SHRUBS				Meal	1			B.G.	95
				Phpr	1			LITTER	4
				Gunk-3	1			MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 8

OBSERVER: Wondzell
DATE: 8-10-90

ELEVATION: 3363.91
DISTANCE: 274.80
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand 100 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: (18 dead 6"-12" CW saps) still lots of beaver damage ↙ v. little shrubs sparse herbaceous cover - still dense CW above - mostly Phpr, Cispp, AsFo, Claw-Alpha/pha - Som/

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	9	12	3								
ES												

TREE*	DBH	HT	AGE	REMARKS
CW	7.2	26	10	Representative tree
ES	-	11.0	6	6 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	:	0.0	1	AsFo	3 (20)			ROCK	
Rowo	:	0.0	1	Fgar	1			B.G.	75
Alte	·	0.0	1	Gunk-3	1			LITTER	1
								MOSS	-
								OTHER	2 Tree

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 9

OBSERVER: Wondzell
DATE: 8-10-90

ELEVATION: 3363.34
DISTANCE: 291.20
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand 100 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: even aged @ bed similar size (dbh + ht) CW: sparse understory of Phpr, Fgar, Agspp, AsFo, - Much less bvr damage, also fewer CW saplings, i.e. more large trees - 4 CW bvr.

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	1	2 1	3								

TREE*	DBH	HT	AGE	REMARKS
CW	3.1	33	16	Typical tree of CW 3" ±
CW	2.7	28	12	" " " 1-3"

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	·	0.0	1	AsFo	2			ROCK	
				Gunk-3	1			B.G.	75
				Gunk-1	1			LITTER	5
				Phpr	1			MOSS	10
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 10

OBSERVER: Wondzell
DATE: 8-10-90

ELEVATION: 3363.93
DISTANCE: 307.60
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand 100 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: lots of lg. woody debris in plots 1-10 & 1-11 (i.e. a 12"-24" diameter tree lying across the plots w/ branches extending into both). The [illegible] (4-12 ft [illegible] frame) is close to [illegible] even less [illegible]

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	4	2 1	3 -								

TREE*	DBH	HT	AGE	REMARKS
CW	4.3	36	18	largest tree in plot
CW	2.8	30	12	typical tree " "

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Gunk-3	1			ROCK	-
No SHRUBS								B.G.	65
								LITTER	35
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 11

OBSERVER: M. Wondzell
DATE: 8-10-98

ELEVATION: 3363.87
DISTANCE: 324.0
ROOTED SUBSTRATE: - boulder 5 cobble - gravel - sand 95 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: this plot v. similar to all others previously, ∴ will not age trees, assume it is still v. close to previous - No dead CW?

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1		2	3								
ES												

TREE*	DBH	HT	AGE	REMARKS
CW	2.4	23	11	Age of trees 1-3" dbh ≈ 10-12 years

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	·	0.0	1	AsFo	1			ROCK	-
Sgel	·	0.0	1					B.G.	75
Shca	·	0.0	1					LITTER	20
Acgl	·	0.0	1					MOSS	5
Sabe	·	0.3	1					OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 12 DATE: 8-10-90

ELEVATION: 3363.96
DISTANCE: 340.4
ROOTED SUBSTRATE: – boulder 5 cobble – gravel + sand 95 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland (Most. fines)

COMMENTS:
Starting to break out of CW thicket - CW tend to be only slightly smaller [illegible] shrubs + ES - all [illegible] still [illegible]

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	3	2	3								
ES	–											

TREE	DBH	HT	AGE	REMARKS
CW	2.6	25	12	Typical tree
ES	–	1.0	7	All ES 0.5 - 1.5 ft tall

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca		0.0	1	AsFo	3(15)			ROCK	
Acgl		0.0	1	Taof	1			B.G.	65
Cost		0.0	1	Phpr	1			LITTER	10
Alte		0.0	1	Anar	1			MOSS	
Syal		0.0	1					OTHER	10 Tree stem

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 13 DATE: 8-10-90

ELEVATION: 3364.15
DISTANCE: 356.8
ROOTED SUBSTRATE: __ boulder 10 cobble __ gravel 90 sand __ fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS:
few cobbles mostly fines, [illegible] channel + cobble ridge [illegible] to old channel - more shrubs + ES appearing - moss [illegible] - Angelica present.

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
DF	0	0										
CW	3	3	2	3								
LA	0	0										

TREE	DBH	HT	AGE	REMARKS
CW	3.6	35	15	
CW	2.1	22	10	
ES	–	1.0	7	[illegible] DF = [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca		1		Taof	2	GUNK-6	1	ROCK	–
Acgl		2		AsFo	3(10)			B.G.	60
Alte		1		Mespp	1			LITTER	5
Cost		1		GUNK-1	1			MOSS	1
				GUNK-3	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 14 DATE: 8-10-90

ELEVATION: 3364.05
DISTANCE: 373.2
ROOTED SUBSTRATE: – boulder 10 cobble __ gravel 90 sand – fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS:
[illegible] channel + edge of CW stand, another row of cobbles parallel to the channel [illegible] more open [illegible] small 1-2" CW [illegible] CW's [illegible]

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		2	2	3	4							
ES												
DF		0										
BI			2									
LA		0										

TREE	DBH	HT	AGE	REMARKS
CW	5.5	50	19	largest CW in area
CW	2.7	26	[illegible]	ave. age of CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		–	2	Asmo	1	Gunk-3	1	ROCK	65
Cost		–	1	AsFo	2			B.G.	20
				Frvi	1			LITTER	1
				Chle	1			MOSS	–
				Meol	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 15 DATE: 8-10-90

ELEVATION: 3363.19
DISTANCE: 389.6
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 20 sand __ fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS:
[illegible] willow [illegible] 3' dia. log [illegible] little herbaceous

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		1	2	3								
ES												

TREE	DBH	HT	AGE	REMARKS
CW	4.1	36	16	[illegible]
CW	3.2	38	14	typical of most CW
ES	–	1.0	6	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca		–	1	AsFo	1			ROCK	–
Spbe		–	1	Gunk-1	1			B.G.	40
[illegible]		8.0	4					LITTER	10
								MOSS	1
								OTHER	45

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 16 DATE: 8-10-90

ELEVATION: 3362.52
DISTANCE: 406.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 00 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
channel bank - 3-4' tall - lots of willow - no trees
v. few forbs/grass. Some [illegible] - willows all 10-12' tall

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
c												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 1	∴	3.5	2	Cisfa	1			ROCK	0
Salix 2	··	0	3	chle	1			B.G.	94
Salix 3	⁝	2.6	2	Acfo	1			LITTER	5
Cost	□	3.8	1					MOSS	1
Salix 4	·	0	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 17 DATE: 8-10-90

ELEVATION: 3358.77
DISTANCE: 422.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
old channel bed w/ lots willows No Trees
COST is small [illegible] - willows 10-12' tall

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 1	⁚	0.8	3	Egar	1			ROCK	–
Salix 4	□	11.9'	5					B.G.	100
Salix 3	⁘	1'	1					LITTER	–
Cost	[illegible]	1.9	2					MOSS	1
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 18 DATE: 8-10-90

ELEVATION: 3357.73
DISTANCE: 438.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: X channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: No trees, [illegible] in channel [illegible] - all willow + Cost. - no herb. w/in 1/2 x 1.
willow 8-12' tall

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 1	[illegible]	7.7	4					ROCK	–
Salix 4	[illegible]	1.4	3					B.G.	95
Salix 3	[illegible]	–	1					LITTER	5
Cost	13	0.2	1					MOSS	-
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 19 DATE: 8-10-90

ELEVATION: 3359.83
DISTANCE: 455.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] sparse willows - no trees [illegible]
100' [illegible] 50' [illegible] adjacent to plot [illegible]
[illegible]

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE*	DBH	HT	AGE	REMARKS:
ES	14.3	45	49	[illegible] = 33 [illegible]
CW	34.7	110	?	[illegible] of [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 1	·	2.2	1						
Salix 3	[illegible]	1.0	1	Cisar	1			ROCK	–
Rupa	[illegible]	1.3	2						
[illegible]	[illegible]	2.4	2	[illegible]	1			B.G.	25
Syal	[illegible]	3.0	2	[illegible]	1			LITTER	50
Amal	[illegible]	-	1						
Amal	·	-	1					MOSS	10
Cost	[illegible]	7.1	3					OTHER	10 [illegible]

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 20 DATE: 8-10-90

ELEVATION: 3367.43
DISTANCE: 491.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Up on [illegible] - old floodplain: [illegible] old CW + spruce + SA [illegible] to plot. none in plot.

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA		•										

TREE	DBH	HT	AGE	REMARKS
SA	<1"	5	12	Age estimate from whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	•		1						
COST	••	4.0	1	AgPo	2			ROCK	–
SAVA	[tally]	2.5	3	Gush-7	1			B.G.	–
[illegible]	[tally]	3.4	3					LITTER	90
[illegible]	1	4	1						
RUPA	[tally]	0.5	2					MOSS	5
ACGL	⁛	0	1					OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 21 DATE: 8-10-90

ELEVATION: 3367.63
DISTANCE: 497.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90% sand 10% fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Dead 3" Dia. tree across plot, parallel to line - lots of yellow sweet clover, lots of litter - 2 mature ES trees, [illegible] seedlings + shrubs.

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	••				•	•						
LA	•	•										
SA	⊏											
WWP	•											
DF	::											

TREE	DBH	HT	AGE	REMARKS
ES	5.3	30'	21	Small spruce in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Sava	[tally]	0.6	3						
SYAL	[tally]	0.3	3	Gush-3 (?)	2			ROCK	–
Rowo (?)	[tally]	•	2						
RuPa	[tally]	•	2	ANAP	2			B.G.	–
Cost	[tally]	1.5	2						
Acgl	[tally]	4.5	2	FAVI (?)	1			LITTER	25
AMAL	[tally]	•	1						
Bere (?)	[tally]	•	1	AsFo	1			MOSS	–
				Clco	2			OTHER	[illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 22 DATE: 8-10-90

ELEVATION: 3368.50
DISTANCE: 503.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Mature forest, DF Bi CW ES, SA w/ dense understory of many shrubs + white clover [illegible] of wheatgrass + Timothy - [illegible] [illegible] is dead - [illegible] trees [illegible] plot - many in adjacent plots

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF	⁖											1 - 39.2
ES		•										
SA	::											

TREE	DBH	HT	AGE	REMARKS
DF	39.2	120		[illegible] tree [illegible] - too big to drill
ES	-	4.0	10	} [illegible] [illegible] seedlings
DF	-	1.6	7	[illegible] occasional spruce

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal	[tally]	0.2	2						
Sava (?)	[tally]	1.7	2	Gush-7	2	Prvu (?)	1	ROCK	–
Rupa	[tally]	1.0	3						
Amal	'	0.4	1	Frvi	1	Pape	1	B.G.	5
Acgl	[tally]	5.5	3						
Bele (?)	'	0.2	1	Jisp (?)	1			LITTER	50
Salix-4	'	0.0 (?)	1						
				Gush 1	2			MOSS	—
				Gush 4	2			OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1 OBSERVER: Wondzell
PLOT NUMBER: 23 DATE: 8-10-90

ELEVATION: 3368.94
DISTANCE: 519.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Still mature forest of ES, SA, DF, Bi w/ dense undergrowth. No trees in plot but small seeds/saps. Adjacent to the plot though [illegible] DF, ES, SA, Bi

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES		•										
DF	••											
SA	•											

TREE	DBH	HT	AGE	REMARKS
ES	-	3.8	10	10 whorls
DF	-	2.1	7	7 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-4	•	–	1	Anma	1			ROCK	-
Cost	[tally]	–	1	Cisap (?)	2			B.G.	5
Syal	[tally]	0.2	2	Gush-7	3			LITTER	25
Rupa	[tally]	0.4	2					MOSS	-
Sava	[tally]	–	1					OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 24
OBSERVER: Wondzell
DATE: 8-10-90

ELEVATION: 3366.10
DISTANCE: 536.3
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Same as 23

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA			1		4							

TREE	DBH	HT	AGE	REMARKS
SA	6.5	40	90	Seemingly typical size for SA. all DF + ES, CW [illegible] much larger

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		8.0	4	Gutt-v	1	Cisp.	1	ROCK	–
Sasc		3.6	3	Smra	2	Arco?	1	B.G.	5
Rupa		1.1	3	Egar	1			LITTER	10
Cornus		0.0	1	Frvi	1			MOSS	5
Syal.		2.8	2	Thoc	1			OTHER	60 shrubs

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 1
PLOT NUMBER: 25
OBSERVER: Wondzell
DATE: 8-10-90

ELEVATION: 3366.40
DISTANCE: 552.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Again mature forest of ES, SA, DF no cottonwood!
[illegible]

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES							6					
SA						5						
DF												

TREE	DBH	HT	AGE	REMARKS
ES	11.9	60		Typical trees here
SA	8.4	50	47	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Sava		0.6	2	Thoc	1			ROCK	–
Oopo		1.9	2						
Salix-1		–	1	Egar	1			B.G.	–
Acgl		–	3	Smra	2			LITTER	60
Syal		–	1						
Rawo		–	1	Dagl	1			MOSS	5
Cupa		1.5	3	Ptaq	1			OTHER	10 Shrubs

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 1
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3365.77
DISTANCE: 339.0
ROOTED SUBSTRATE: ___ boulder 10 cobble ___ gravel 90 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
2/3 of plot up on shelf, 1/3 on bank - a steep 5' bank.
Mostly cobbles overlain w/ sand. v. small young CW w/ bank
falling away + ≈ 1 dz. CW laying in stream - no willow - veg. same on bank + shelf

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	3	1	0								
ES												

TREE	DBH	HT	AGE	REMARKS
CW	2.4	20	12	One of larger saps; most have been cut down by
CW	1.0	15	7	beaver + then resprouted ∴ lots of < 1" saps.
ES	–	0.4	5	Seedlings

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte	1	0.0	1	AsFo	4	Acmi	1	ROCK	–
				Taof	1			B.G.	60
				Egar	1			LITTER	5
				Phpr	1			MOSS	–
				Gunk-8	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 2
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3365.78
DISTANCE: 355.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
v. sandy + very uniform [illegible] ≈ 15-18 ft tall.
v. little [illegible] Pepr common [illegible]

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	3	1	2								
ES												

TREE	DBH	HT	AGE	REMARKS
CW	1.4	21	14	Typical of most CW, all CW ≥ 1" in dbh
ES	–	0.6	4	4 whorls - [illegible] 2, others only 0.3' [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				AcFo	2			ROCK	–
NO SHRUBS				Me spp.	1			B.G.	90
				Gunk-9	1			LITTER	5
								MOSS	–
								OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 3 DATE: 8-15-90

ELEVATION: 3365.83
DISTANCE: 371.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: This plot almost identical to # 2-2. 1-2" CW dominate w/ mixture of Asfo, Popr, Gunk-2, Melilotus spp. Gunk 8 + Gunk-1. [illegible]

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]									
ES	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	1.6	17	15	seem the typical tree.
ES	-	0.5	3	3 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Taof	1			ROCK	–
NO SHRUBS				Asfo	3			B.G.	50
				Mesp	1			LITTER	30
				Popr	1			MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 4 DATE: 8-15-90

ELEVATION: 3365.82
DISTANCE: 388.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel [illegible] sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Same as 2-2, 2-3. almost identical; CW here perhaps a little smaller [illegible] <1" + fewer 1-2". More open. [illegible] 2-3 & 2-4 [illegible] 2-2 & 2-3.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]									
ES	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	1.6	19	15	Typical CW
ES	-	0.9	6	6 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
NO SHRUBS				Chle	1			ROCK	–
				Acmi	2			B.G.	70
				Asfo	3			LITTER	1
				Meal	1			MOSS	–
				Gunk-9	1			OTHER	10

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 5 DATE: 8-15-90

ELEVATION: 3366.29
DISTANCE: 404.6
ROOTED SUBSTRATE: ___ boulder 5 cobble ___ gravel 95 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] more open - more herbaceous vegetation. still 1-2" CW throughout all 15-18' tall

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]									
ES	[illegible]											
DF	[illegible]	[illegible]										
LA	[illegible]											
WWP	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	1.2	13	12	Typical CW
DF	-	5.8	17?	12 whorls - largest DF all rest are 1' seedlings
ES	-	1.2	8	8 whorls - typical of larger ES most 0.2 - 0.8' tall

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	[illegible]	0.0	1	Meal	2	Popr	1	ROCK	–
				Cere	2	Chle	1	B.G.	40
				Asfo	2			LITTER	20
				Gunk-8	1			MOSS	3
				Gunk-1	1			OTHER	5

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 6 DATE: 8-15-90

ELEVATION: 3366.58
DISTANCE: 421.0
ROOTED SUBSTRATE: ___ boulder 30 cobble ___ gravel 72 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Sand entry of [illegible] [illegible] elevation - still made up of 1-2" dbh + 15-18' tall CW. this plot is still [illegible] before, [illegible] looks diff [illegible] CW [illegible]

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		[illegible]	[illegible]									
ES	[illegible]											
DF	[illegible]											
WWP	[illegible]											
SA	[illegible]											
LA	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	1.6	14	22	Typical CW
				*All other conifers from 0.4 to 2.5' tall
				+ are anywhere from 4 - 12 yrs old?

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	[illegible]	0.0	1	Gunk-8	1			ROCK	5
				Meal	2			B.G.	60
				Asfo	1			LITTER	10
				Cere	2			MOSS	20
				Chle	1			OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 7 DATE: 8-15-90

ELEVATION: 3367.34
DISTANCE: 437.4
ROOTED SUBSTRATE: ___ boulder 10 cobble ___ gravel 80 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Still [illegible] CW towards 2-3" dbh instead of 1-2" dbh

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]									
ES	[illegible]											
DF	[illegible]											
LA	[illegible]											
SA	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	2.4	21	21	Typical of 1-3" class; conifers similar to plot 2-6, in terms of size & age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No Shrubs				AsPo	1	Phpr	1	ROCK	–
				Meel	2	Gramk-6	1	B.G.	25
				Chk	1			LITTER	50
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 9 DATE: 8-15-90

ELEVATION: 3368.42
DISTANCE: 470.2
ROOTED SUBSTRATE: ___ boulder 10 cobble ___ gravel 60 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: V. similar to plot 2-8. Still lots of conifer seedlings, few if any shrubs.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]	[illegible]	4							
ES	[illegible]											
DF	[illegible]	[illegible]										
SA	[illegible]											
WWP	[illegible]											
LA	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	5.7	41	23	3 diff size classes but the same age?
CW	3.3	36	19	
CW	1.5	24	22	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Spbe	[illegible]	0.0	1	Chk	1			ROCK	–
Acgl	[illegible]	1.3	2	AsFo	2			B.G.	20
Cos-	[illegible]	0.0	1	Meal	2			LITTER	60
								MOSS	–
								OTHER	10

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 8 DATE: 8-15-90

ELEVATION: 3367.91
DISTANCE: 453.8
ROOTED SUBSTRATE: ___ boulder 5 cobble ___ gravel 90 sand 5 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] 2-4' & 25-30' [illegible] Still no shrubs

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		[illegible]	3	2								
ES	[illegible]											
DF	[illegible]											
LA	[illegible]											
SA	[illegible]											
WWP	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	3.3	34	22	largest tree in plot
CW	2.0	25	16	typical of most 1-3" CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No Shrubs				AsFo	1	Gramk-8	1	ROCK	–
				Taof	1			B.G.	20
				Meal	1			LITTER	75
				Acmi	1			MOSS	5
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 10 DATE: 8-15-90

ELEVATION: 3368.92
DISTANCE: 486.6
ROOTED SUBSTRATE: ___ boulder 5 cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Nothing [illegible] just CW stand w/ conifer seedlings. Most CW in 1-3" [illegible] a few more shrubs appearing.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	[illegible]	[illegible]	[illegible]								
ES	[illegible]											
DF	[illegible]											
SA	[illegible]											
LA	[illegible]											

TREE*	DBH	HT	AGE	REMARKS
CW	3.2	31	20	largest tree in plot; All conifers still in seedling stage [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	[illegible]	0.0	1	Meal	2	Cere	1	ROCK	2
Syal	[illegible]	0.0	1	Gramk-8	1	Chle	1	B.G.	–
Alte	[illegible]	0.0	1	AsFo	1	Popa	1	LITTER	85
Acgl	[illegible]	0.0	1	Gramk-5	1	Taot	1	MOSS	–
				Phpr	1			OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 11 DATE: 8-15-90

ELEVATION: 3369.22
DISTANCE: 503.0
ROOTED SUBSTRATE: ___ boulder 20 cobble ___ gravel 50 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
1-3' [illegible] CW - [illegible] ES seedlings - understory [illegible] mostly
Asfo Melilotus spp, Gunk-5, Gunk-8 + ES + SA + DF seedlings [illegible]
- soil/litter 1-3" thick on top of cobble

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	7	1	12	2								1
ES												
DF												
SA												
WWP												

TREE*	DBH	HT	AGE	REMARKS:
CW	2.5	26	20	Typical CW
				#1 ES seedlings ≈ 1.0' tall

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)4	COVER CLASS5	GRASS FORB	COVER CLASS5	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	•	0.0	1	Meal	1	Gunk-5	1	ROCK	0
Alte	•	0.0	1	Cera	1			B.G.	0
Syal	•	0.0	1	Taof	1			LITTER	60
				Asfo	1			MOSS	10
								OTHER	25

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 12 DATE: 8-15-90

ELEVATION: 3369.23
DISTANCE: 519.4
ROOTED SUBSTRATE: 1 boulder 5 cobble - gravel 50 sand 45 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Starting to open up again - fewer CW + the CW are smaller!
fewer ES seedlings, mostly moss + litter + soil cover - [illegible]
Hardly any grass spp. - Gunk-9, Gunk-8 + Pope - only sparsely.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1	1	27	1	3	0						1
ES												
DF												
SA												
WWP												
LA												

TREE*	DBH	HT	AGE	REMARKS:
CW	3.7	39	20	[illegible] CW - dominant tree - more open grown
ES	-	1.5	10	mostly 1-2' tall [illegible] whorls
SA	-	0.5	5	5 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)4	COVER CLASS5	GRASS FORB	COVER CLASS5	GRASS FORB	COVER CLASS	OTHER	% COVER
Sxca	•	0.0	1	Funk-3	1			ROCK	3
Acgl	•	0.0	1	Mespp	2			B.G.	0
Syal	•	0.0	1	Asfo	1			LITTER	
				Taof	1			MOSS	10
								OTHER	10

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 13 DATE: 8-15-90

ELEVATION: 3369.40
DISTANCE: 535.8
ROOTED SUBSTRATE: ___ boulder 5 cobble ___ gravel 70 sand 25 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Open, only small CW, occasionally [illegible] 1-2" or 2-3" CW
[illegible] moss [illegible] moss [illegible] cobble + sandy
[illegible] soil - conifers are a little taller here

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	0	9	11	3								1
ES												
DF												
SA												
WWP												
LA												

TREE*	DBH	HT	AGE	REMARKS:
CW	1.1	14	9	Most CW this size (i.e. just barely > 1") or smaller
CW	4.5	36	23	Only one of this size

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)4	COVER CLASS5	GRASS FORB	COVER CLASS5	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	•	3.0	1	Mespp	1	Gunk-9	1	ROCK	–
				Cerc	1	Gunk-8	1	B.G.	–
								LITTER	25
								MOSS	50
								OTHER	25

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 14 DATE: 6-15-90

ELEVATION: 3369.78
DISTANCE: 552.2
ROOTED SUBSTRATE: ___ boulder 10 cobble ___ gravel 80 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
V. open - small CW - mostly moss, sand, cobble
understory mostly Melilotus + Asfo - v. little grass

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	10	8	1	1								1
ES												
DF												
SA												
WWP												

TREE*	DBH	HT	AGE	REMARKS:
CW	2.2	17	18	[illegible] tree all other CW too small to [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)4	COVER CLASS5	GRASS FORB	COVER CLASS5	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	•	0.0	1	Asfo	1	Gunk-8	1	ROCK	20
Amal	•	0.0	1	Taof	1			B.G.	–
Sal[illegible]	•	0.0	1	Mesit	1			LITTER	20
Rowo	•	0.0	1					MOSS	40
								OTHER	15

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 15 DATE: 8-15-90

ELEVATION: 3364.50
DISTANCE: 568.6
ROOTED SUBSTRATE: ___ boulder 30 cobble ___ gravel 50 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar 1/2 channel bank 1/2 channel shelf ___ floodplain ___ upland
COMMENTS: On the [illegible] [illegible] side channel [illegible] ES, DF seedlings + saplings [illegible] [illegible] grass. Bank slope ≈ 10%.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												
ES												
DF												
SA												
WW*												
LA												

TREE*	DBH	HT	AGE	REMARKS
CW	1.8	16	15	One of 3 1-2" CW, all rest saps.
ES	0.8	7'	16	16 whorls + [illegible] 4 16 rings

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		0.0	2	Care	1			ROCK	5
Alte		0.0	1	Meal	1			B.G.	–
				AsFo	1			LITTER	5
								MOSS	90
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 16 DATE: 8-15-90

ELEVATION: 3367.30
DISTANCE: 585.0
ROOTED SUBSTRATE: ___ boulder 30 cobble ___ gravel 30 sand 40 fines
LANDFORM TYPE: 1/2 channel bed ___ depositional bar 1/2 channel bank ___ channel shelf ___ floodplain ___ upland
COMMENTS: 1/2 plot in old channel, other 1/2 on left bank, gentle bank 10% slope; [illegible] [illegible] - Some [illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												
ES												
DF												
SA												
LA												

TREE*	DBH	HT	AGE	REMARKS
CW	3.1	21	17	[illegible] CW in plot
ES	1.9	12	12	12 [illegible] + 13 whorls } [illegible] in plot
DF	1.5	14	10	10 [illegible] + [illegible] whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte		0.0	1	Chle	2	Phpr	1	ROCK	0
Acgl		0.0	2	Asfo	1	Gunk-B	1	B.G.	0
Salix		0.0	1	Meal	2	Gunk-9	1	LITTER	50
Ruph		0.0	2	Trof	1	Gunk-4	2	MOSS	25
				Egar	1	Anar	1	OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 17 DATE: 8-15-90

ELEVATION: 3366.91
DISTANCE: 601.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland
COMMENTS: In channel bottom, v. open, few trees, mostly grass + forbs. Only 1 shrub + only a few trees.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												
ES												

TREE*	DBH	HT	AGE	REMARKS
				No trees old enough to age
				all ES seedlings 0.1-0.9 ft tall

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		0.0	1	Care	1	Gunk-8	1	ROCK	–
				Meal	2	Phpr	1	B.G.	90
								LITTER	5
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 18 DATE: 8-15-90

ELEVATION: 3365.36
DISTANCE: 617.8
ROOTED SUBSTRATE: ___ boulder 5 cobble ___ gravel 55 sand 40 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland
COMMENTS: In bed of old channel again, mostly forbs + grasses, only a few trees + shrubs

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												
ES												
DF												
SA												

TREE*	DBH	HT	AGE	REMARKS
CW	2.7	21	15	Typical of the few CW in channel bottom
ES	–	4.2	9	9 whorls.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		0.0	1	Meal	2	AsFo	1	ROCK	–
				Acmi	1			B.G.	10
				Care	1			LITTER	10
				TeoF	1			MOSS	60
				Chle	1			OTHER	15

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 19
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3365.92
DISTANCE: 634.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ½ channel bed ___ depositional bar ½ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
[illegible] v.v. dense herb vegetation + shrub veg. – most shrubs on bank – steep 3' bank [illegible] No other trees other than 2 dead CW [illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	dead only		1 2									

TREE*	DBH	HT	AGE	REMARKS:
NO	TREES	TO	AGE.	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		8.2	2	Cispp.	1	Gunk-5	1	ROCK	0
Amal		0.4	2	Meal	2	Gunk-8	3	B.G.	0
Syal		3.8	3	Anma	1	Gunk-9	3	LITTER	40
Sama		0.2	1	Gunk-1	1	Phpr	1	MOSS	–
Rupa		0.4	1			Popr	2	OTHER	30 shrubs

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 20
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3369.85
DISTANCE: 650.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 40 sand 60 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ½ channel shelf ½ floodplain ___ upland

COMMENTS:
Almost up on old [illegible] floodplain about ½ plot is gently sloping right bank of old channel other half is flat w/ ES, SA, DF + BI Trees, no CW present

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA							5 0					

TREE*	DBH	HT	AGE	REMARKS:
SA	15.0	50	32	only 1 tree in plot, several just outside

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl		10.?	4	Egar	1			ROCK	–
Rupa		0.8	2						
Syal		5.?	3					B.G.	10
Sera		1.2	2						
Cost		0.0	1					LITTER	50
								MOSS	–
								OTHER	40 – Tree stem

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 21
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3369.48
DISTANCE: 667.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 40 sand 60 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Mostly ES + SA forest w/ occasional BI + DF. Shrub community is thick (esp Sara, Syal, Rupa) Besides Funk-4, there are [illegible] – grasses – There are several 4-8" CW in site [illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES					3 0		4 1					
SA				4 0	5 0							

TREE*	DBH	HT	AGE	REMARKS:
ES	6.7	55	25	> growing next to each other
SA	5.8	53	22	
CW	8.8	58	27	in adjacent site just downstream from (2-21)

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal		2.3	4	Egar	1	Gunk-12	1	ROCK	–
Sara		6.0	4						
Acgl		4.2	4	Funk 3	1			B.G.	–
Sawe		0.1	1						
Cost		0.0	1	Funk-4	1			LITTER	25
Rupa		0.5	1					MOSS	50
Amal		0.0	1						
								OTHER	20

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2
PLOT NUMBER: 22
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3371.07
DISTANCE: 683.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
2 large ES in plot, 1 dead [illegible] understory is [illegible] + [illegible] + SARA

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES							4 0			2 1		
CW			2									

TREE*	DBH	HT	AGE	REMARKS:
ES	11.9	46	74	Dead top
CW	1.8	23	21	being crowded out by ES

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Amal		0.0	1	Egar	1			ROCK	–
Rupa		1.2	1						
Syal		0.0	1	Urd.	3			B.G.	–
Sera		4.1	1						
Acgl		0.4	1	Sara	2			LITTER	65
Cost		0.0	1	Funk-4	1			MOSS	–
Ocrs		3.8	2					OTHER	10 shrubs

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 23 DATE: 8-15-90

ELEVATION: 3371.43
DISTANCE: 699.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Few trees, but plot is surrounded by lg ES, SA, RI ... understory is Opho, Urdi, Hela, Egar – Shrub counts not ... accurate ... Opho + Urdi is so thick

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	1:											

TREE*	DBH	HT	AGE	REMARKS:
				Seedlings too deformed to count whorls.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)[4]	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	OTHER	% COVER
Cost	1	1.1	1	Hela	3	Gunk-13	1	ROCK	—
Opho	[illegible]	7.6	5	Egar	2	Gunk-3	1	B.G.	—
Rupa	[illegible]		1	Thoc	1	Gunk-7	1	LITTER	20
[illegible]	[illegible]		2	Urdi	1			MOSS	50
Acgl	·		1					OTHER	10 shrubs

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 24 DATE: 8-15-90

ELEVATION: 3370.70
DISTANCE: 716.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 35 sand 65 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
V. Thick Cost Acgl on ½ of plot, other ½ is thick w/ Gunk-1, Hela, Rupa & Egar

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	[illegible]							Broken top – dead tree 21				
ES	:											

TREE*	DBH	HT	AGE	REMARKS:
SA	–	1.5	8-10	8-10 whorls.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)[4]	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	OTHER	% COVER
Acgl	[illegible]	1.8	3	Egar	2	Gunk-5	1	ROCK	—
Cosl.	::	5.2	4	Ptag	3	Gunk-12	1	B.G.	—
Opho	:	0.0	1	Hela	2	Gunk-3	1	LITTER	25
Rupa	[illegible]	0.0	1	Stam	1	Carex-1	3	MOSS	25
Rust	::	0.0	1	Smra	1	Gunk-1	1	OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 25 DATE: 8-15-90

ELEVATION: 3369.55
DISTANCE: 732.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 20 sand 80 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Last 3 plots are ... in a small opening created by ... trees, canopy ... shrub + herb cover is heavy. Adjacent to opening is large ... ES ... tops of adjacent ... there

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]											
SA	::											

TREE*	DBH	HT	AGE	REMARKS:
ES	–	1.8	8	8 whorls
SA	–	1.2	6	6 whorls – dead top

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)[4]	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	OTHER	% COVER
Acgl	[illegible]	0.8	3	Smra	1	Gunk-8	1	ROCK	
Sy...	·	0.0	1						
Opho	[illegible]	0.0	1	Egar	2	Carex-1	1	B.G.	
Cost	:	0.0	1	Asfo	1	Gunk-5	1	LITTER	
Rust	::	0.2	1	Cisop	1	Ptag	2	MOSS	
Rupa	[illegible]	2.4	2	Gunk-4	1	Php?	1	OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 2 OBSERVER: Wondzell
PLOT NUMBER: 26 DATE: 8-15-90

ELEVATION: 3370.04
DISTANCE: 744.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Did not string stake, but moved 5m×5m plot & drove a ... into ... string mount. STOPPED @ 25. # 26 will be similar to #25. Rough estimates were made – too difficult to set up plot.

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES		·		·								
SA	::											

TREE*	DBH	HT	AGE	REMARKS:
ES	4.5	21	36	Also another small ES but w/ dead top.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)[4]	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	GRASS FORB	COVER CLASS[5]	OTHER	% COVER
Syal	[illegible]	2.5	2						
Opho	[illegible]	3.5	2	Thoc	2	Gunk-3	1	ROCK	—
Rupa	:1	0.0	1	Smra	3	Carex-1	1	B.G.	–
Acgl	[illegible]	1.7	2	Egar	2	Gunk-12	1	LITTER	75
Cosl.	::	0.0	1					MOSS	—
Sara	[illegible]	0.8	2					OTHER	—

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 1 DATE: 8-15-90

ELEVATION: 3366.68
DISTANCE: 345.0
ROOTED SUBSTRATE: ___ boulder 25 cobble 25 gravel 25 sand 25 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ½ channel bank ½ channel shelf ___ floodplain ___ upland

COMMENTS: step 5' high cobble bank 45° slope [illegible] ½ plot is the bank the other ½ is shelf. The shelf is 6-12" [illegible] [illegible] bank is [illegible] [illegible] CW [illegible] [illegible] [illegible] [illegible] [illegible] v little herb veg

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			2 1	3 2	4 -	5						

TREE*	DBH	HT	AGE	REMARKS
CW	7.5	52	15	represents 3 size classes in the plot { all abt the same age!
CW	3.7	38	15	
CW	1.4	20	13	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Saliz4	·	0.0	1	AsFo	2	Gnak-8	2	ROCK	–
								B.G.	75
								LITTER	10
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 2 DATE: 8-15-90

ELEVATION: 3366.91
DISTANCE: 365.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Mixture of diff size CW - lots of sand deposited, around trunks of trees, v few shrubs + v. little herb. veg - some horsetail here but diff from [illegible] ES/SA [illegible] flood plain.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			2 3	6 4	-		6 -					

TREE*	DBH	HT	AGE	REMARKS
CW	8.6	60	16	represent all 3 size classes { all = same age!
CW	3.3	43	14	
CW	1.8	36	15	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 4	:	3.0	1	Gnak-5	1			ROCK	
Rowo		0.0	1	Sowi	1			B.G.	
								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 3 DATE: 8-15-90

ELEVATION: 3366.83
DISTANCE: 381.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: v. similar to 3-1 + 3-2 - same comments - most of smaller cw saps appear to be dying also.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			2 3	6 4	0 5	0 6	0					

TREE*	DBH	HT	AGE	REMARKS
CW	7.2	64	17	represent each size class
CW	4.0	49	14	
CW	2.4	32	15	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix4	·	0.0	1	AsFo	1			ROCK	–
Rowo	·	0.0	1					B.G.	95
Cost	·	0.0	1					LITTER	3
Acel	:	0.0	1					MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 4 DATE: 8-15-90

ELEVATION: 3367.97
DISTANCE: 398.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Slight increase in elevation - still all sand - a few ES, SA seedlings more shrubs herb. veg.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			1 2	3 4	0 5	0						
ES	⊠											
SA	:·											

TREE*	DBH	HT	AGE	REMARKS
CW	5.8	58	16	represents 2,3 size classes
CW	4.0	51	18	
CW	1.6	32	14	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rivi	:	0.0	1	Somi	1	Gnak-3	1	ROCK	–
Augl	··	0.4	1	Epar	1			B.G.	80
Cost	:	0.0	1					LITTER	10
Alte	⁚⁚	0.0	1					MOSS	–
Amel	⊏	0.0	1					OTHER	5 tree

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3
PLOT NUMBER: 5
OBSERVER: Wondzell
DATE: 8-19-90

ELEVATION: 3368.33
DISTANCE: 414.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW seem to be becoming more alike in size (few small cw) Almost all CW v. close to 3.0" dia.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			3	8	4							
ES	[illegible]											
SA	11											
DF	:											
WWP	·											

TREE*	DBH	HT	AGE	REMARKS
CW	3.0	40	19	Representative CW ... CW appear to be getting ≈ 4 + older? maybe?
ES	-	0.5	5	≈ 0.5' to ll. 5 whorls.
SA	-	0.4	4	all ≈ 0.3-0.5' tall 3-4 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	l:	0.0	1	ArPo	1	Gunk 3	1	ROCK	–
Cost	::	0.0	1	Crspp	1			B.G.	90
Arte	l:	0.0	1	Mespp	1			LITTER	5
Amal	[illegible]	0.0	1					MOSS	–
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3
PLOT NUMBER: 6
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3369.17
DISTANCE: 431.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW are more uniform in size (both dia. + ht.) Few small saps - most have died - + most 1-3" trees are closer to 3" than 1".

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			3	4	4							
ES	[illegible]											
SA	[illegible]											
WWP	·											
DF	:											

TREE*	DBH	HT	AGE	REMARKS
CW	4.1	42	18	Most living CW are similar in size + age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	:·	0.0	1	Taof	2	Gunk 3	1	ROCK	–
Acgl	:·	0.0	1	Aslo	2	Fnpr	1	B.G.	30
[illegible]	:	0.0	1	Cere	1			LITTER	50
[illegible]	·	0.0	1					MOSS	–
Bere	·	0.0	1						
[illegible]	:·	0.0	1					OTHER	5

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3
PLOT NUMBER: 7
OBSERVER: Wondzell
DATE: 8-19-90

ELEVATION: 3369.60
DISTANCE: 447.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW stand starting to open up a little - lower density of stems - most CW appear to be even-age, even size Most CW ± 3" dbh

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		[illegible]	[illegible]	[illegible]	10							
ES	[illegible]											
SA	[illegible]											
DF	:											
WWP	:·											

TREE*	DBH	HT	AGE	REMARKS
CW	3.3	43	17	[illegible] most 2.9 - 3.5 trees in plot
ES	–	1.8	11	11 whorls
SA	-	1.3	6	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost / [illegible]	[illegible]	[illegible]	[illegible]	Cere	1	Popr	1	ROCK	–
[illegible]	[illegible]	0.0 / 0.0	[illegible]	Asfo	2	Gunk 3	1	B.G.	–
[illegible]	[illegible]	0.0	1	Taof	2			LITTER	40
				Mespp	1			MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3
PLOT NUMBER: 8
OBSERVER: Wondzell
DATE: 8-15-90

ELEVATION: 3370.15
DISTANCE: 463.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW stand becoming even more open this is last plot that is ± entirely w/in CW stand. CW trees are larger (4-5" dbh) + taller so is ES.; Sand layer not as thick, cobbles just 4-6" down

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		1	3	4	4							
ES	[illegible]	0										
SA	::											

TREE*	DBH	HT	AGE	REMARKS
CW	5.0	42	24	largest size class
ES	0.6	5.8	14	tallest ES in plot
CW	3.2	36	20	most trees this size

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	::	0.0	[illegible]	Aslo	1			ROCK	–
Acgl	::	0.0							
Amal	::	0.0	[illegible]	Gunk 6	1			B.G.	–
				Cere	1			LITTER	85
								MOSS	–
								OTHER	15

Figure 43. Continued.

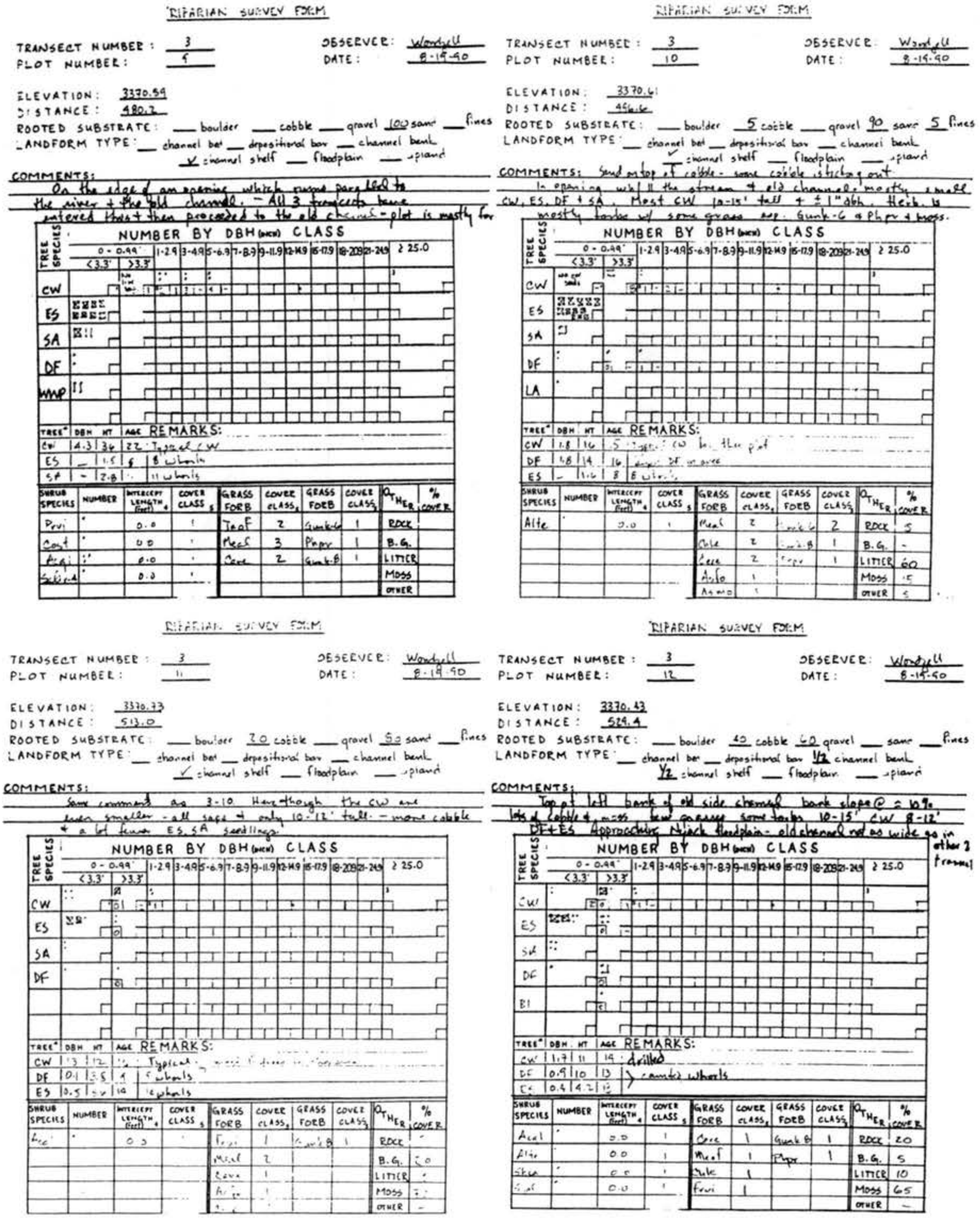


Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 13 DATE: 8-19-90

ELEVATION: 3368.00
DISTANCE: 545.8
ROOTED SUBSTRATE: ___ boulder 10 cobble ___ gravel 90 sand ___ fines
LANDFORM TYPE: ½ channel bar ___ depositional bar ½ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: ½ plot is on left bank of old channel other ½ in bed of old channel. mostly forbs, CW, ES v. little grass stake is in channel bed right at bottom of left bank.

NUMBER BY DBH (inch) CLASS — tree species: CW, ES, SA, BI, DF

TREE	DBH	HT	AGE	REMARKS
CW	1.1	14	15	[illegible]
DF	1.0	10	10	[illegible]
ES	1.8	11	3	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Angl		0.0	1	Somi	1	Pupr	1	ROCK	–
Cost		0.0	1	Taof	1	[illegible]	1	B.G.	25
				Mcel	2	Gaco-3	1	LITTER	10
				CWe	2			MOSS	15
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 14 DATE: 8-19-90

ELEVATION: 3366.73
DISTANCE: 562.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ½ channel bed ___ depositional bar ½ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Stake @ bottom of rt. bank ½ plot is old channel bed w/ a few trees, some shrubs & lots forbs. other ½ is rt. bank wh/ is steep (45°) + thick w/ alot of shrub spp. (Sora, Cost, Syal, Ripa, Angl) A definite change in veg. comp. from channel bed to bank

NUMBER BY DBH (inch) CLASS — tree species: CW, ES

TREE	DBH	HT	AGE	REMARKS
CW	2.4	22	16	Only cw in plot
ES	–	19	9	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Ruid / Cost		[illegible]	[illegible]	Mcel	2	Gank-3	1	ROCK	–
Pupe / Angl		0.2 / 4.0	3 / 2	Meof	2	[illegible]	1	B.G.	25
Syal		3.1	2	Asfo	1	Phpr	1	LITTER	65
Sore / Beal		0.0 / 0.0	1 / 1	Somi	1			MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 15 DATE: 8-19-90

ELEVATION: 3370.85
DISTANCE: 578.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel ___ sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ✓ floodplain ___ upland

COMMENTS: Channel shelf / floodplain (i.e. Mック flats). Extremely thick/dense veg. esp. shrubs. Mostly ES/SA tree community w/ occasional DF, BI.

NUMBER BY DBH (inch) CLASS — tree species: ES, SA

TREE	DBH	HT	AGE	REMARKS
ES	4.4	24	16	largest ES (in ES)
SA	3.3	19	16	largest SA

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Ripa / Syal / Sora / Ruid / Cost / Rilo / Angl / Acgl / Amal / Alia	[illegible]	[illegible]	[illegible]	Smra	1	Gank-5	1	ROCK	
				Epan	1			B.G.	
								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 16 DATE: 8-19-90

ELEVATION: 3370.93
DISTANCE: 595.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf X floodplain ___ upland

COMMENTS: v. little herb. - mostly Egan + dense shrub. On Muck flats. Mostly ES forest. 3 lg. (20"+ dbh) logs lie through the plots. V. diverse shrub comm.

NUMBER BY DBH (inch) CLASS — tree species: CW, ES, SA, BI, WH

TREE	DBH	HT	AGE	REMARKS
[illegible]	[illegible]	[illegible]	[illegible]	only CW in plot another 4.5" just outside
[illegible]	[illegible]	[illegible]	2	Much larger ES just outside plot
[illegible]	[illegible]	[illegible]	[illegible]	only BI [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Opho / Sora / Ruid / Syal / Acgl / Acbu / Cost / Rilo	[illegible]	0.0 / 3.8 / 5.5 / 1.6 / 7.8 / 1.2 / 3.0 / 3.0	[illegible]	Gank-4				ROCK	
				Egan				B.G.	
								LITTER	
								MOSS	
								OTHER	

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 17 DATE: 8-15-90

ELEVATION: 3369.94
DISTANCE: 611.4
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel [illegible] sand [illegible] fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf [illegible] floodplain ___ upland

COMMENTS:
ES/SA [illegible] 3 [illegible] logs [illegible]
in [illegible]

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
SA	II											

TREE*	DBH	HT	AGE	REMARKS:
ES	[illegible]	[illegible]	[illegible]	Most ES in area are still a little larger than this one
SA	[illegible]	16	24	Growing along side the ES [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	1.7	3						
opho	[illegible]	6.7	4	[illegible]	1			ROCK	—
[illegible]	[illegible]	1.1	2						
[illegible]	[illegible]	[illegible]	4	[illegible]	1			B.G.	—
[illegible]	[illegible]	3.0	1	[illegible]	1			LITTER	70
				[illegible]	1			MOSS	[illegible]
								OTHER	[illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 18 DATE: 8-19-90

ELEVATION: 3370.05
DISTANCE: 627.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf X floodplain ___ upland

COMMENTS:
No trees other than a few SA seedlings, tallest one is 4'
Shrubs dominate, mostly COST - OPHO + RUPA

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
SA												

TREE*	DBH	HT	AGE	REMARKS:
SA	-	7.7	5	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Riin	[illegible]	0.0	1						
Rowo	[illegible]	0.4	1	[illegible]	[illegible]	[illegible]	2	ROCK	—
Rupa	[illegible]	2.3	2						
Opho	[illegible]	[illegible]	[illegible]	Popa	1	Egar	[illegible]	B.G.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	2.0	1	[illegible]	1	Sese	[illegible]	LITTER	[illegible]
Cost	[illegible]	1.4	3						
Acgl	[illegible]	0.0	2	[illegible]	1	Hela	2	MOSS	[illegible]
Eust	[illegible]	2.0	1	[illegible]	1	[illegible]		OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 19 DATE: 8-19-90

ELEVATION: 3370.37
DISTANCE: 644.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf X floodplain ___ upland

COMMENTS:
Same as 3-18 - A few more ES + SA seedlings

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
SA												

TREE*	DBH	HT	AGE	REMARKS:
ES	—	[illegible]	[illegible]	[illegible]
SA	-	[illegible]	10	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
COST	[illegible]	4.1	2						
PUST	[illegible]	0.0	1	Stam	1	[illegible]	[illegible]	ROCK	-
ACGL	[illegible]	3.0	2						
[illegible]	[illegible]	[illegible]	1	Sese	[illegible]	[illegible]	1	B.G.	10
[illegible]	[illegible]	[illegible]	1						
OPHO	[illegible]	[illegible]	1	Egar				LITTER	30
RIIN	[illegible]	0.0	1						
RUPA	[illegible]	1.4	2	Hela	[illegible]			MOSS	25
Rowo	[illegible]	[illegible]	1					OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 3 OBSERVER: Wondzell
PLOT NUMBER: 20 DATE: 8-15-90

ELEVATION: 3370.36
DISTANCE: 660.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf X floodplain ___ upland

COMMENTS:
Same as 3-18 + 3-19 A few less ES + SA, 2 lg ES (12" + 30")
[illegible]
skunk cabbage + cow parsnip.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
SA												
BI												

TREE*	DBH	HT	AGE	REMARKS:
ES	2.0	11	13	Only ES in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	[illegible]	[illegible]	3						
[illegible]	[illegible]	5.8	4	[illegible]	2	[illegible]	3	ROCK	—
Eupe	[illegible]	0.3	1						
Opho	[illegible]	[illegible]	1	Sese	1	[illegible]	1	B.G.	10
Syal	[illegible]	0.0	1	Egar	1	[illegible]	1	LITTER	45
[illegible]	[illegible]	0.0	1	Phpr	1	[illegible]	1	MOSS	15
				Pope	1			OTHER	—

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 1 DATE: 8-20-90

ELEVATION: 3372.43
DISTANCE: 163.00
ROOTED SUBSTRATE: ___ boulder 50 cobble 40 gravel 10 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Gravel/cobble bar w/ 4-6' willow, a few CW seedlings. No herb. vegetation!

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	.											

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-7	::	5.4	5	No grass or		forbs		ROCK	90
								B.G.	10
								LITTER	–
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 2 DATE: 8-20-90

ELEVATION: 3373.62
DISTANCE: 179.35
ROOTED SUBSTRATE: ___ boulder 50 cobble 40 gravel 10 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Same as 4-1 - gravel, cobble bar w/ no herb. veg

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		. 10										

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				No grass /		forbs		ROCK	75
								B.G.	25
								LITTER	–
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 3 DATE: 8-20-90

ELEVATION: 3374.26
DISTANCE: 195.58
ROOTED SUBSTRATE: ___ boulder 40 cobble 50 gravel 10 sand ___ fines
LANDFORM TYPE: ___ channel bed X depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Willow + CW seeds/saps only; no other herb. veg.

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		:: 10										

TREE*	DBH	HT	AGE	REMARKS:
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	.	5.4	2	No grass/		forb		ROCK	70
Salix-1	.	0.0	2					B.G.	30
Salix-7	.	1.9	2					LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 4 DATE: 8-20-90

ELEVATION: 3375.20
DISTANCE: 212.00
ROOTED SUBSTRATE: ___ boulder 30 cobble 60 gravel 10 sand ___ fines
LANDFORM TYPE: ___ channel bed x depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
No herb. - CW seeds/saps + willow

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	::	⊐ 10										

TREE*	DBH	HT	AGE	REMARKS:
CW	0.8	10	8	Only CW lg. enough to count/age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-7	.	0.8	1	No grass/		forb		ROCK	[illegible]
Salix-6	.	0.0	1					B.G.	[illegible]
								LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 5
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3375.01
DISTANCE: 228.4
ROOTED SUBSTRATE: ___ boulder 5 cobble 90 gravel 5 sand ___ fines
LANDFORM TYPE: ___ channel bed X depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Again Willow/CW bar - mostly all gravel - some horsetail

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE# | DBH | HT | AGE | REMARKS: [illegible]
Some (5) CW seeds only 0.1' tall

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				Egar	1			ROCK	98
								B.G.	1
								LITTER	-
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 6
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3374.45
DISTANCE: 244.8
ROOTED SUBSTRATE: ___ boulder ___ cobble 50 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed 1/2 depositional bar 1/2 channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Top of gently sloping left bank to side channel that is wet & lined annually, some Gunk-1, Meal, Meof & Gunk-4 - Stake is located at the break

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE# | DBH | HT | AGE | REMARKS: [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		2.0	1	[illegible]	1			ROCK	-
				Gunk-4	1			B.G.	100
								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 7
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3371.57
DISTANCE: 260.96
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: 1/2 channel bed ___ depositional bar 1/2 channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Stake is @ bottom of left bank - all sand no herb in 1/2 x 1 plot some Egar, Gunk-1 + Gunk-8 in the 5x5 No trees or shrubs

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE# | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	-
No shrubs				No herbs				B.G.	100
								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 8
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3369.94
DISTANCE: 277.40
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Stake - most of plot is under water - some moss [illegible] - No trees No shrubs No herbs

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE# | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	
No Shrubs				No herbs				B.G.	
								LITTER	
								MOSS	
								OTHER	100 water

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 9
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3375.27
DISTANCE: 282.48
ROOTED SUBSTRATE: ___ boulder 10 cobble 10 gravel 60 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Right bank of side channel - 1' high bank [illegible] [illegible] - Rose [illegible] [illegible] Popr [illegible] - no real diff in veg. from top to bottom of bank

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE*	DBH	HT	AGE	REMARKS:
				No CW old enough to age [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rowo		3.0	2	Chu	2			ROCK	40
Sa[illegible]		0.0	1	Sm[illegible]	1			B.G.	35
Rid		0.0	1	Melilo	1			LITTER	10
								MOSS	-
								OTHER	10 - Shrub

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 10
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3381.45
DISTANCE: 308.94
ROOTED SUBSTRATE: ___ boulder ___ cobble 80 gravel 15 sand 5 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Organic layer 1-2" on top of pea-size gravel + sand on top of island - flat shelf, entire plot same elev. V. lg CW (35") + DF (20") adjacent to the plot.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE*	DBH	HT	AGE	REMARKS:
				No CW lg. enough to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rowo		0.0	1	Asfo	1	G[illegible]	1	ROCK	1
Syal		0.0	1	Meof	2			B.G.	-
				Gsp	1			LITTER	80
				Frvi	1			MOSS	5
				Acro				OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 11
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3375.82
DISTANCE: 325.39
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
On top of island - large DF + CW. A few DF seedlings in the adjacent area

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF												

TREE*	DBH	HT	AGE	REMARKS:
DF	16.0	75	93	Only tree in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal		1.5	2	AsFo	2	Brin	2	ROCK	-
Acgl		0.0	1	Meal	3	Popa	1	B.G.	-
Rowo		0.0	2			Gunk-3	1	LITTER	70
Rupa		0.0	1			Phpr	1	MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 12
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3375.53
DISTANCE: 341.73
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
On top of island. More veg - shrubs - trees esp. seedlings some litter from trees/branches etc.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA												
CW												

TREE*	DBH	HT	AGE	REMARKS:
SA	5.0	26	45	Only SA lg enough to age
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rowo / Shca		0.0 / 5.0	1 / 1	Acmi	2	Gunk 5	2	ROCK	-
Acgl		0.0	2	Cispp	2	Phpr	2	B.G.	5
Syal		1.0	2	Chle	2	Gunk 5	1	LITTER	50
Bere		0.0	1	Meal	3			MOSS	5
[illegible]		[illegible]	1					OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 13 DATE: 8-20-90

ELEVATION: 3380.17
DISTANCE: 358.11
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Island top - lg CW just outside plot - no CW regen mostly SA regen + a few spruce. - this is typical of the area as a whole

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES			1									
DF										1		
SA	LI	8										

TREE*	DBH	HT	AGE	REMARKS:
ES	1.6	11	15	-
DF	20.1	105	130	Typical of large DF in the area

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	[illegible]	0.0	1	Asfo	1	[illegible]	3	ROCK	-
Shca / Sava	[illegible]	0.0 / 0.5	1 / 2	Anev	1	Frpr	1	B.G.	-
Cost	[illegible]	[illegible]	2	Cisp	1	[illegible]	1	LITTER	50
Spal	[illegible]	[illegible]	1			[illegible]	[illegible]	MOSS	[illegible]
[illegible]	[illegible]	[illegible]	1					OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 14 DATE: 8-20-90

ELEVATION: 3378.6
DISTANCE: 374.23
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 40 sand 60 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: ½ x 1 plot + stake is in pile of litter, ES, DF, SA branches/sticks. Under a heavy canopy, v. little light ∴ little veg + shrub veg

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF			dead 0 1			4	7					
CW											1	
ES			dead 1 1	3		4						

TREE*	DBH	HT	AGE	REMARKS:
CW	23.2	120	150	Typical CW. 150 is approx # of [illegible]
DF	11.6	[illegible]	115	- ± smaller than typical DF in area
ES	8.3	42	102	Dead top

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	·	0.0	1	Egar	1	Gumb-S	1	ROCK	-
Cost	·	0.0	1	Cisp	1			B.G.	-
								LITTER	95
								MOSS	
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 15 DATE: 8-28-90

ELEVATION: 3379.44
DISTANCE: 360.66
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Thick upper story canopy, very little forbs + grasses, a few smaller + Egar. lots of dead rotten logs, + some moss.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES						2		7				
DF								7				
SA												

TREE*	DBH	HT	AGE	REMARKS:
DF	12.8	75	102	Typical DF for this area
ES	13.8	75	85	Typical ES " " "

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	[illegible]	0.0	1					ROCK	—
Cost	·	0.0	1	No Forbs / Grasses				B.G.	1
Spal	·	0.0	1					LITTER	[illegible]
								MOSS	[illegible]
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 16 DATE: 8-20-90

ELEVATION: 3378.36
DISTANCE: 406.83
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: On edge of ES/DF/CW stand at kept edge of ls. area still on island but breaking out into opening. the ½ of this plot that is closest to opening has more grass/forbs - other ½ is mostly litter

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	1			3				9				
SA												

TREE*	DBH	HT	AGE	REMARKS:
ES	13.6	77	111	Typical ES
ES	3.3	[illegible]	72	Small understory spruce

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	[illegible]	[illegible]	[illegible]	Egar	[illegible]			ROCK	-
Spal	[illegible]	[illegible]		[illegible]	1			B.G.	—
Cost	[illegible]	[illegible]		[illegible]				LITTER	[illegible]
Shca								MOSS	[illegible]
Rowo								OTHER	

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wendell
PLOT NUMBER: 17 DATE: 8-20-90

ELEVATION: 3379.31
DISTANCE: 423.29
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Small opening, [illegible] of ES/SA regen. v. thick herb cover + shrub cover. v. diverse comm.

NUMBER BY DBH (inch) CLASS

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]	[illegible]	[illegible]	[illegible]								
SA	[illegible]	[illegible]										
CE		[illegible]										

TREE*	DBH	HT	AGE	REMARKS:
ES	3.0	16	15	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal	[illegible]	[illegible]	2	Cisp[illegible]	1	[illegible]	1	ROCK	–
Rowo	[illegible]	[illegible]	2	[illegible]	1	[illegible]	2	B.G.	–
Ruga Alle	[illegible]	[illegible]		[illegible]	1	[illegible]	2	LITTER	50
Pamy Ruin	[illegible]	[illegible]		[illegible]	1	[illegible]	1	MOSS	50
Acgl cels	[illegible]	[illegible]						OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wendell
PLOT NUMBER: 18 DATE: 8-20-90

ELEVATION: 3379.66
DISTANCE: 435.42
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 20 sand 80 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Small opening / meadow w/ v. thick grass - most ES very close to 1" dbh - Mostly Gr[illegible]-3, Cale, Phpr

NUMBER BY DBH (inch) CLASS

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
LA		[illegible]	[illegible]									
ES	[illegible]	[illegible]	[illegible]									
SA	[illegible]	[illegible]	[illegible]									

TREE*	DBH	HT	AGE	REMARKS:
[illegible]	1.5	10	13	largest ES [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-S	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	3	ROCK	–
Rupa	[illegible]	[illegible]	1	[illegible]	1	[illegible]	1	B.G.	[illegible]
Cost	[illegible]	[illegible]	1	Acla	1	[illegible]	1	LITTER	[illegible]
Acgl Syal	[illegible]	[illegible]		Meof	[illegible]	[illegible]	1	MOSS	[illegible]
Rowo	[illegible]	[illegible]	1	[illegible]		[illegible]	[illegible]	OTHER	[illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wendell
PLOT NUMBER: 19 DATE: 8-20-90

ELEVATION: 3378.47
DISTANCE: 455.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
On upstream edge of small opening / meadow v. similar to 4-18 but no ES/SA seedlings. Only 1 lg. ES on upstream edge of plot

NUMBER BY DBH (inch) CLASS

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES										[illegible]		

TREE*	DBH	HT	AGE	REMARKS:
ES	[illegible]	85	71	Extremely young for this size - v. open site
				[illegible] ES of similar size

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	2	ROCK	–
				[illegible]	[illegible]	Phpr	[illegible]	B.G.	–
				[illegible]		[illegible]		LITTER	[illegible]
				[illegible]				MOSS	50
								OTHER	[illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wendell
PLOT NUMBER: 20 DATE: 8-20-90

ELEVATION: 3379.51
DISTANCE: 472.04
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
On edge of meadow - back into ES/SA over + understories - some CW sapl present - ½ plot still has lots grass/forb. Stake + ½ x 1 plot is @ base of 2 ES seedlings

NUMBER BY DBH (inch) CLASS

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]	[illegible]	[illegible]									
CW		[illegible]										
SA	[illegible]											

TREE*	DBH	HT	AGE	REMARKS:
ES	1.1	8	[illegible]	lgst ES sapling
CW	[illegible]	14	–	lgst CW sapling in plot - dead center no age
CW	33	[illegible]	10	CW just outside plot lgst in small stand

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-S	[illegible]	0.0	1	Frvi	1	[illegible]	1	ROCK	–
Pust Syal	[illegible]	[illegible]	[illegible]	[illegible]	1			B.G.	–
Cost	[illegible]			[illegible]	1			LITTER	[illegible]
Alte	[illegible]	[illegible]	[illegible]	Meof	1			MOSS	[illegible]
Acgl [illegible]	[illegible]	[illegible]		Cispp	1			OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 21 DATE: 8-20-90

ELEVATION: 3381.41
DISTANCE: 488.24
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Stake up on a high spot as are all the ES saplings. One lg ES in plot. v. thick ... of ES' A small (50 m²) stand of 1-3" CW 15-20' tall at this elev. + dist + just downstream from here (i.e. outside the plot)

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]	[illegible]										
CW		1		2								
SA	[illegible]											
BI		1										

TREE	DBH	HT	AGE	REMARKS
ES	13.2	57	55	V [illegible]
ES	0.1	4.0	11	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca	[illegible]	[illegible]	1	[illegible]	2			ROCK	—
Sava	[illegible]	[illegible]	1	[illegible]	1			B.G.	-
Alte	[illegible]	[illegible]	1	Eqar	1			LITTER	[illegible]
[illegible]	[illegible]	[illegible]	1					MOSS	[illegible]
[illegible]	[illegible]	[illegible]	1					OTHER	5 [illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 22 DATE: 8-20-90

ELEVATION: 3381.02
DISTANCE: 584.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 20 sand 80 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Back into ES overstory - lots of litter on ground - area is shaded + few if any shrubs + forbs.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]	[illegible]					[illegible]	[illegible]				

TREE	DBH	HT	AGE	REMARKS
ES	13.8	67	82	[illegible]
LA	12.1	76	82	Just outside the plot - [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rust / Salix-S	[illegible]	0.0 / 0.0	[illegible]	Eqar	1	[illegible]	1	ROCK	—
CST / Sava	[illegible]	1.4 / [illegible]	[illegible]	[illegible]	[illegible]			B.G.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]					LITTER	[illegible]
Eufe	[illegible]	[illegible]	[illegible]					MOSS	[illegible]
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 23 DATE: 8-20-90

ELEVATION: 3378.88
DISTANCE: 621.00
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 20 sand 80 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Similar to 4-22 [illegible]

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	[illegible]			[illegible]		2	6					
SA	[illegible]											
WWP	[illegible]											
BI			2									

TREE	DBH	HT	AGE	REMARKS
ES	11.2	60	70	largest ES in plot
BI	1.9	24	-	Only BI in plot - so small will age older ones in next plot.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible] / Rust	[illegible]	3.0 / 1.4	3 / 1	Asfo	1	[illegible]	3	ROCK	-
Powo / Rupe	[illegible]	0.0 / 0.0	1 / 1			[illegible]	1	B.G.	-
						Papr	1	LITTER	40
								MOSS	50
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 24 DATE: 8-20-90

ELEVATION: 3380.98
DISTANCE: 537.20
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Out of Spruce canopy for a few pts. - V. few forbs - v. little grass - mostly a tangle of shrub species - on top of old old log-jam

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
BI				2								
ES							[illegible]					

TREE	DBH	HT	AGE	REMARKS
BI	3.5	24	15	Only BI in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte / Rowo	[illegible]	0.0 / 1.9	1 / 3	C. spp	1	[illegible]	1	ROCK	[illegible]
Rust / Rupa	[illegible]	1.2 / 1.4	1 / 2	Chle	1			B.G.	
Cost	[illegible]	5.6	4	[illegible]	1			LITTER	[illegible]
Acgl	[illegible]	0.0	[illegible]					MOSS	-
								OTHER	[illegible]

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 25
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3381.78
DISTANCE: 553.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 40 sand 60 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: No trees [illegible] 2 and 12-13' base of [illegible] ES, + 1 ES seedling

NUMBER BY DBH (inch) CLASS — Tree species: ES

TREE*	DBH	HT	AGE	REMARKS
ES	-	1.9	8	8 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost		15.0	5	Ca spp.	1			ROCK	-
Rust		1.8	2	Egar	1			B.G.	-
Powo		0.0	1						
Rose		0.0	1						
Alte		0.0	1					LITTER	60
Syal		0.0	1					MOSS	40
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 26
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3382.38
DISTANCE: 570.20
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: [illegible]

NUMBER BY DBH (inch) CLASS — Tree species: LP, ES

TREE*	DBH	HT	AGE	REMARKS
LP	4.5	22	13	Only LP in entire Transect
ES	-	3.0	10	Typical ES

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rust		0.0	1	Anax	1	Gunk-8	1	ROCK	-
Cost		8.9	4	Ca spp	1			B.G.	-
Iule		0.0	1					LITTER	95
								MOSS	-
								OTHER	5 [illegible]

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 27
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3384.98
DISTANCE: 586.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: [illegible]

NUMBER BY DBH (inch) CLASS — Tree species: CW

TREE*	DBH	HT	AGE	REMARKS
CW	16.1	60	82	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	6	7.0	3	[illegible]	2			ROCK	-
Rust	16	1.7	2	Pepa	1			B.G.	20
Amal	1	0.0	1	Egar	1			LITTER	75
Rypr	3	0.0	1	[illegible]	1			MOSS	5
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 28
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3381.63
DISTANCE: 603.18
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 95 sand 5 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: [illegible]

NUMBER BY DBH (inch) CLASS — Tree species: CW, L9

TREE*	DBH	HT	AGE	REMARKS
CW	22.7	90	103	[illegible] edge of bank [illegible] top of bank [illegible]
L9	3.5	31	19	[illegible] channel bed

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	7	2.5	2	Egar	1			ROCK	-
Rypr	4	0.0	1	Funk 7	1			B.G.	-
Rust	5	0.7	1	Funk 6	1			LITTER	99
								MOSS	1
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 29 DATE: 8-20-90

ELEVATION: 3376.07
DISTANCE: 616.48
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ½ channel bank ½ channel shelf ___ floodplain ___ upland
COMMENTS: DF + CW [illegible] bank, all [illegible] trees on top of bank [illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF					1							1
ES	1	3										
SA	2	1										
CE	1											
BI	1		2									
CW										1		

TREE*	DBH	HT	AGE	REMARKS:
DF	5.4	31	36	On top of [illegible] bank
CW	18.4	85	102	" " "
BI	2.2	22	17	in channel [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	10	1.2	2	Egar	2			ROCK	
Alte	2	1.2	1	[illegible]	1			B.G.	
[illegible]	1	0.0	1	Cispp	1			LITTER	
[illegible]	2	0.0	1	[illegible]	1			MOSS	
				[illegible]	1			OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 30 DATE: 8-20-90

ELEVATION: 3374.87
DISTANCE: 635.98
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland
COMMENTS: on channel shelf, mostly willows & grasses [illegible] old [illegible] choked w/ willows v. few CW.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	1											

TREE*	DBH	HT	AGE	REMARKS:
				All CW too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte	[illegible]	6.5	3	Asmo	1	[illegible]	3	ROCK	–
[illegible]	[illegible]	0.0	2	AsFo	1	[illegible]	2	B.G.	30
[illegible]	[illegible]	0.0	2			[illegible]	1	LITTER	40
[illegible]	[illegible]	7.0	3					MOSS	5
Cost	[illegible]	1.5	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 31 DATE: 8-20-90

ELEVATION: 3375.27
DISTANCE: 652.18
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 95 sand 5 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland
COMMENTS: On channel shelf young alder, cw + willows

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	1										

TREE*	DBH	HT	AGE	REMARKS:
				No [illegible] to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	0.0	1	Egar	1			ROCK	-
[illegible]	[illegible]	10.8	3					B.G.	100
COST	[illegible]	0.0	1					LITTER	-
Alte	[illegible]	3.6	2					MOSS	-
[illegible]	[illegible]	0.0	1					OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 32 DATE: 8-20-90

ELEVATION: 3375.57
DISTANCE: 668.88
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland
COMMENTS: Shelf in old channel bed mostly all willows 6-10' high, some CW - a channel shelf below floodplain + [illegible] channel which creates the island.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	3	1										

TREE*	DBH	HT	AGE	REMARKS:
				Too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	8.3	3	Cispp	1			ROCK	–
[illegible]	[illegible]	2.2	2	Egar	1			B.G.	90
[illegible]	[illegible]	6.0	4	Mespp	1			LITTER	5
Alte / Cost	[illegible]	0.3 / 0.0	1 / 1	[illegible]	1			MOSS	3
[illegible]	[illegible]	0.0	1					OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 33
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3376.97
DISTANCE: 685.08
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Below island + above the active channel. Rt. bank of small channel actually just a slight rise could be a rise in channel shelf but prob. more like bank to small gulley, no diff. in veg. comm. though: perhaps more grass

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	::	::	·|·									
Bl	·	·										
SA	·											

TREE	DBH	HT	AGE	REMARKS
CW	1.1	14	14	Only 1 lg. enough to drill

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
COST	[illegible]	0.9	2	Acfo		Gunk 3	3	ROCK	–
Salix	[illegible]	3.0	4			Gunk 5	2	B.G.	30
Salix	–	–	–			Gunk 4	1	LITTER	40
Salix	[illegible]	8.1	3					MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 34
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3377.67
DISTANCE: 701.28
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: High pt again within the willow bench, next plots drop down into another little gulley - entire area though must receive water during high Q events - Veg same; some ES

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	·		·									
ES	·	·										
SA	::											

TREE	DBH	HT	AGE	REMARKS
				Too small - no ages

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]	ROCK	–
[illegible]	[illegible]	0.0	1	[illegible]	1	[illegible]		B.G.	[illegible]
Salix	[illegible]	1.5	2	[illegible]	[illegible]	[illegible]	[illegible]	LITTER	50
Salix	[illegible]	1.5	2			[illegible]	[illegible]	MOSS	–
Salix	[illegible]	[illegible]	1			[illegible]		OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 35
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3372.93
DISTANCE: 717.58
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Stake is in bottom of small gulley, rest of plot rises on both sides up to small bank or rises...

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		··										

TREE	DBH	HT	AGE	REMARKS
				2 small CW, 2 small [illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	[illegible]	2.0	2	[illegible]	1	[illegible]	1	ROCK	–
Salix-1	[illegible]	[illegible]	1			[illegible]	1	B.G.	[illegible]
Salix-3	[illegible]	2.[illegible]	3			[illegible]	1	LITTER	[illegible]
Salix-4	[illegible]	[illegible]	[illegible]					MOSS	
Salix 6 / Salix 7	[illegible]	[illegible]	[illegible]					OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4
PLOT NUMBER: 36
OBSERVER: Wondzell
DATE: 8-20-90

ELEVATION: 3374.93
DISTANCE: 733.98
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: channel shelf with mostly willow, some Alder & Elk; a lot of willow flood-trained + laid down - receive water/flow during moderate to high discharge.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	::	::										

TREE	DBH	HT	AGE	REMARKS
				Too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
COST	[illegible]	1.1	1	No grass					
RUM	[illegible]		1					ROCK	[illegible]
Salix 1	[illegible]		1		or forb				
Salix 2	[illegible]		1					B.G.	[illegible]
Salix	[illegible]	[illegible]	1					LITTER	[illegible]
Salix / Salix	[illegible]		[illegible]					MOSS	[illegible]
Salix / Salix	[illegible]	[illegible]	[illegible]					OTHER	

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 37 DATE: 8-20-90

ELEVATION: 3376.53
DISTANCE: 750.58
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: high bench in channel bench - still choked with willow/some grass (? beaver damage CW ranging from 1-5" dbh, 1' high stumps)

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	:											
SA	·											
DF	··											
CW		⊠	dead									

TREE	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Sage cost	⊠⊠	2.4	1	Somi	1	Gun? B	3	ROCK	-
Salix-G Ruse	⊠	3.3	2	Meal	1			B.G.	80
Salix [illegible]	·	-	1					LITTER	5
[illegible]	:	1.3	1					MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 38 DATE: 8-20-90

ELEVATION: 3377.03
DISTANCE: 766.48
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: lot of willow cover before drop into side channel that create the island

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	⊠⊠:·											
ES	⊠⊠⊠:·											
WWP	:											
DF	:											
CW		::										

TREE	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Bel	·	1	1						
Alte	:·	1	1	Lepa	1	Gunk-B	2	ROCK	-
Cest	·	1	1						
Salix-6	⊠⊠⊠⊠:·	11.8	5	Somi	1	Pope	1	B.G.	55
Salix-1	⊠⊠:·	2.4	3	Meal	1	Phpr	1	LITTER	50
Salix-				Gar	1	Gunk-6	1	MOSS	5
						Gunk-5	1	OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 39 DATE: 8-20-90

ELEVATION: 3370.87
DISTANCE: 799.18
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: left bank of side channel, stake is [illegible] of left bank, 1/2 plot is left bank other 1/2 is channel bed, channel bed is devoid of veg.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
Cw	·	:										
SA	:											

TREE	DBH	HT	AGE	REMARKS:
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-U	⊠:	6.0	2					ROCK	-
Alte	:·	6.0	2	No grass; No forbs				B.G.	99
Salix-1	:	1	1					LITTER	1
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 40 DATE: 8-28-90

ELEVATION: ~~3366.??~~ 3370.17
DISTANCE: ~~816.08~~ 799.18
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: channel bed all fines + sand No veg.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	
No shrubs				No forbs / grass				B.G.	99
								LITTER	1
								MOSS	
								OTHER	— 100%

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 41 DATE: 8-20-90

ELEVATION: 3368.17
DISTANCE: 816.08
ROOTED SUBSTRATE: ___ boulder 40 cobble – gravel 30 sand 30 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Stake is 1.5 below water. Channel bottom - No veg

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				No Forb/grass				ROCK	50
								B.G.	50
								LITTER	–
								MOSS	–
								OTHER	–

100%

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 42 DATE: 8-20-90

ELEVATION: 3377.92
DISTANCE: 833.79
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar 1/4 channel bank ___ channel shelf ___ floodplain 1/4 upland

COMMENTS:
Right bank of side channel that extends up into upland. Bank 4½' tall - almost vertical bank upland extremely steep slope - Most of plot is upland -- v. little veg. on bank only veg is on top of bank + upslo

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE*	DBH	HT	AGE	REMARKS:
				No trees

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	6.2 / 5.6	3 / 1	[illegible]	2			ROCK	–
[illegible]	[illegible]	3.0 / 0.8	2 / 2	[illegible]	2	No Grasses		B.G.	5
[illegible]	[illegible]	3.3	3	[illegible]	1			LITTER	50
[illegible]		7.5 / 1.6	3 / 1	[illegible]	1			MOSS	
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 4 OBSERVER: Wondzell
PLOT NUMBER: 43 DATE: 8-20-90

ELEVATION: 3389.16
DISTANCE: 847.95
ROOTED SUBSTRATE: ___ boulder ___ cobble 70 gravel 30 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ✓ upland

COMMENTS:
At tailpin, entirely upslope comm. - 1 lg ES + a couple (6) lg. (5") Alder stems.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												

TREE*	DBH	HT	AGE	REMARKS:
ES	16.4	65	58	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte / [illegible]	[illegible]	[illegible]	2	Fe[illegible]	1			ROCK	75
[illegible]	[illegible]	[illegible]	[illegible]	Ac[illegible]	1			B.G.	20
Spa[illegible]	[illegible]		[illegible]			[illegible]		LITTER	[illegible]
Cost		[illegible]						MOSS	–
ACGi								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 1 DATE: 8-23-90

ELEVATION: 3378.19
DISTANCE: 129.6
ROOTED SUBSTRATE: ___ boulder ___ cobble 50 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Cobble/gravel bar w/ is the right bank of main channel
No veg. other than a handful of small clover (Trifolium) growing is along a line - STAKE PULLED

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs								ROCK	50
				No grass/forb				B.G.	50
								LITTER	–
								MOSS	–
								OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 2 DATE: 8-23-90

ELEVATION: 3377.39
DISTANCE: 146.0
ROOTED SUBSTRATE: ___ boulder ___ cobble 50 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
sand/gravel bar - identical to 5-1
No veg. - STAKE PULLED

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	20
No shrubs				No grass/forbs				B.G.	80
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 3 DATE: 8-23-90

ELEVATION: 3378.89
DISTANCE: 162.6
ROOTED SUBSTRATE: ___ boulder 10 cobble 70 gravel 20 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Cobble/gravel bar - NO VEG

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	80
No shrubs								B.G.	20
				No forbs				LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 4 DATE: 8-23-90

ELEVATION: 3377.79
DISTANCE: 176.0
ROOTED SUBSTRATE: ___ boulder 20 cobble 60 gravel 20 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Cobble Gravel bar - No Veg

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	50
								B.G.	50
No Trees shrubs				No grass/forb				LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 5 DATE: 8-23-90

ELEVATION: 3376.29
DISTANCE: 195.5
ROOTED SUBSTRATE: ___ boulder 40 cobble 30 gravel 30 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Cobble/Gravel/Sand bar - no vegetation

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	50
No shrubs				No grass/[illegible]				B.G.	50
								LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: WendyU
PLOT NUMBER: 6 DATE: 8-22-90

ELEVATION: 3374.49
DISTANCE: 211.9
ROOTED SUBSTRATE: ___ boulder 10 cobble 16 gravel 80 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Sand bar - no veg other than small [illegible]

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE#	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				[illegible]-10	1			ROCK	-
No shrubs				(15)				B.G.	100
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: WendyU
PLOT NUMBER: 7 DATE: 8-23-90

ELEVATION: 3374.84
DISTANCE: 228.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Sand/silt bar - No veg

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees.												

TREE#	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Cispp	1			ROCK	-
				[illegible]-10	1	less than		B.G.	100
No Shrubs				(4)		1/4" tall		LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: WendyU
PLOT NUMBER: 8 DATE: 8-23-90

ELEVATION: 3375.19
DISTANCE: 244.9
ROOTED SUBSTRATE: ___ boulder ___ cobble 10 gravel 80 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Sand/Gravel bar - no veg!

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE#	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				[illegible]	1			ROCK	10
				Trifolium	1			B.G.	90
No Shrubs								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: WendyU
PLOT NUMBER: 9 DATE: 8-23-90

ELEVATION: 3375.39
DISTANCE: 261.20
ROOTED SUBSTRATE: ___ boulder 5 cobble 45 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Sand Gravel bar - no veg at all

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE#	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	60
No shrubs				No grass/forbs				B.G.	40
								LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 10 DATE: 8-23-90

ELEVATION: 3375.09
DISTANCE: 277.60
ROOTED SUBSTRATE: ___ boulder ___ cobble 52 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Sand/Gravel bar - No veg - stake Pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE* DBH HT AGE REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	50
No shrubs				No grass/forbs				B.G.	50
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 11 DATE: 8-23-90

ELEVATION: 3374.65
DISTANCE: 264.00
ROOTED SUBSTRATE: ___ boulder 10 cobble 40 gravel 50 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Sand Gravel bar - no veg except forbs - Stake Pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE* DBH HT AGE REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Egar	1			ROCK	40
No Shrubs				Forb-10	1			B.G.	60
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 12 DATE: 8-23-90

ELEVATION: 3374.49
DISTANCE: 310.30
ROOTED SUBSTRATE: 10 boulder 30 cobble 30 gravel 30 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Cobble/gravel bar - embedded - sand/fines - [illegible] no veg stake pulled.

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE* DBH HT AGE REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Egar	1			ROCK	70
No	Shrubs			Forb-10	1			B.G.	30
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 13 DATE: 8-23-90

ELEVATION: 3373.89
DISTANCE: 327.20
ROOTED SUBSTRATE: 30 boulder 30 cobble 15 gravel 25 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Cobble bar - no veg - stake pulled

TREE SPECIES	NUMBER BY DBH (inch) CLASS: 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE* DBH HT AGE REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
				Egar	1			ROCK	65
								B.G.	35
No shrubs								LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 14 DATE: 8-23-90

ELEVATION: 3374.59
DISTANCE: 343.10
ROOTED SUBSTRATE: 20 boulder 30 cobble 15 gravel 35 sand __ fines
LANDFORM TYPE: __ channel bed ✓ depositional bar __ channel bank __ channel shelf __ floodplain __ upland

COMMENTS:
Plot extends across cobble bar to toe of right bank (i.e. left side of island). Willow is almost in plot # ~ 15'

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-7	1			Fund-10	1			ROCK	60
								B.G.	40
								LITTER	
								MOSS	
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 15 DATE: 8-23-90

ELEVATION: 3376.29
DISTANCE: 359.5
ROOTED SUBSTRATE: – boulder 25 cobble – gravel 55 sand 20 fines
LANDFORM TYPE: ½ channel bed __ depositional bar ½ channel bank __ channel shelf __ floodplain __ upland

COMMENTS:
Left bank of island – v. gradual slope – 10%. Willow thicket w/ few cw seeds + small saps. ½ plot still in channel bed, mainly cobbles – other half on left bank of island (which is rt. bank of main channel, channel has ...)

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	:										

TREE*	DBH	HT	AGE	REMARKS:
				All CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	[illegible]	2.8	3	Arlu	1			ROCK	50
Salix-2	[illegible]	2.0	3	Sani	1			B.G.	50
Salix-1	[illegible]	2.6	2					LITTER	-
Salix-3	:	1.3	2					MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: [illegible]
PLOT NUMBER: 16 DATE: [illegible]

ELEVATION: 3377.79
DISTANCE: 375.90
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 90 sand 10 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS:
Up on the island – still willow/cw thicket w/ v. little herb veg – v. sandy

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	::	·									

TREE*	DBH	HT	AGE	REMARKS:
CW	2.3	16	10*	Rotten center – * 10 yrs after rot – ¼" [illegible] ≈ 13 yrs

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	[illegible]	6.6	4	Egar	1	Gunk-8	1	ROCK	
Salix-3	[illegible]	0.0	2	Asfo	1	Popa	1	B.G.	80
Salix-6	[illegible]	3.4	4	Asmo	1	Gunk-4	1	LITTER	5
Salix-7	::	0.8	2					MOSS	
								OTHER	10

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: [illegible]
PLOT NUMBER: 17 DATE: [illegible]

ELEVATION: 3378.37
DISTANCE: 392.32
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 85 sand 15 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank ✓ channel shelf __ floodplain __ upland

COMMENTS:
On channel shelf, slight increase in elevation more CW + fewer willows.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]	::	:									

TREE*	DBH	HT	AGE	REMARKS:
CW	2.1	21	20	lgst. CW in plot

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	[illegible]	2.5	3	Asfo	1	Gunk-1	3	ROCK	-
Salix-2	[illegible]	0.[illegible]	3			Gunk-4	1	B.G.	80
Salix-7	::	0.5	[illegible]			Gunk-6	1	LITTER	10
Salix-3		0.5	1					MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 18 DATE: 8-22-90

ELEVATION: 3379.62
DISTANCE: 405.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Slowly increasing elevation - mostly willow + taller CW + some alder - v. little grass - some Carex + Sami out of 1/2 x1 + in 5x5m plot. 1 2 dead beaver damage CW saps

TREE SPECIES	NUMBER BY DBH (inch) CLASS
CW	
WWP	

TREE*	DBH	HT	AGE	REMARKS:
CW	4.3	31	18	largest CW
CW	3.0	23	13	typical CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		5.0	3	Egar	1	Popa	1	ROCK	—
Salix-4		3.8	3					B.G.	98
Alte		0.0	2					LITTER	2
Salix-3		0.0	1					MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 19 DATE: 8-22-90

ELEVATION: 3381.42
DISTANCE: 425.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 100 sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Small area in channel shelf - Several 1-3" CW saps that have been cut by beavers (total of 15 stumps) Most saps - sprouting from live stumps.

TREE SPECIES	NUMBER BY DBH (inch) CLASS
CW	31
WWP	
ES	
DF	
SA	

TREE*	DBH	HT	AGE	REMARKS:
CW	4.4	39	19	largest CW - all rest saps from beaver stumps.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		12.0	4	Meal	2	Grab-3	1	ROCK	—
Salix-6		7.5	3	Taof	1			B.G.	70
Salix-3		0.0	1					LITTER	5
Shca / Acgl		0.0 / 0.0	2 / 1					MOSS	15
Salix-7		7.0	1					OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 20 DATE: 8-22-90

ELEVATION: 3379.72
DISTANCE: 441.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: small opening just downstream from line of tall CW @ foot of a lg. log-jam @ head of island

TREE SPECIES	NUMBER BY DBH (inch) CLASS
ES	
WWP	
DF	
CW	
SA	

TREE*	DBH	HT	AGE	REMARKS:
				All CW / trees of all spp. too small to drill

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alk / Cost		1.4 / 0.0	2 / 1	Fcal	2	Pape	1	ROCK	—
Salix-3 / Salix-1		0.5 / 2.7	1 / 1	Asfo	1	Grab B	2	B.G.	80
Salix-6		9.0	3	Som.	1			LITTER	5
								MOSS	10
								OTHER	5

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 21 DATE: 8-22-90

ELEVATION: 3380.12
DISTANCE: 457.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Willow thicket - just upstream + just downstream from a log-jam V. little undergrowth mostly Egar

TREE SPECIES	NUMBER BY DBH (inch) CLASS
ES	
WWP	
CW	
SA	
BI	
LA	

TREE*	DBH	HT	AGE	REMARKS:
				All trees too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1 / Salix-6 / Salix-3		0.0 / 13.5 / 1.7	1 / 4 / 3	Mespp	1			ROCK	—
Alte		0.0	1			No grass		B.G.	50
Rowo		0.0	1					LITTER	50
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 22 DATE: 8-22-90

ELEVATION: 3379.52
DISTANCE: 479.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Just at downstream end of log-jam (1-2' away) - stake @ end of log pile v. few herbaceous spp.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		:										
BI		.										
ES	..											
SA	.											

TREE	DBH	HT	AGE	REMARKS

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-3	[illegible]	6.5	3	Somi	:	Gnak-3	1	ROCK	–
Alte	.	4.2	3						
Salix-6	II	3.0	2	Egar	1	Gnak-6	1	B.G.	10
Salix-1	II	2.8	2						
Cost	.		1	Funk-6	1	Prpr	1	LITTER	75
Rowo	.		1					MOSS	10
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 23 DATE: 8/22/90

ELEVATION: 3382.12
DISTANCE: 490.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 10 sand 90 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: an old decomposing log Jam, all of Plot Stake in middle of log-jam

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
BI		.										
ES	:											

TREE	DBH	HT	AGE	REMARKS

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte	.	0.9	1					ROCK	–
Salix-1	.	0.0	1	No grass / forbs				B.G.	–
Cost	..	0.0	1					LITTER	100
Salix-6	:	0.0	1					MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: [illegible]
PLOT NUMBER: 24 DATE: 8-22-90

ELEVATION: [illegible]
DISTANCE: [illegible]
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 75 sand 25 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: On the N side of the log-jam - stand of CW just on the N side of the log-jam.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
[illegible]		:	::	..	-							
ES	:											

TREE	DBH	HT	AGE	REMARKS
CW	6.9	40	19	largest CW
CW	1.9	25	13	typical of stand

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	[illegible]	3.6	3	Egar	1	Gnak-3	1	ROCK	–
Cost	[illegible]	0.0	2					B.G.	40
Rowo	[illegible]	3.6	3					LITTER	60
Pien	.	[illegible]	1					MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 25 DATE: 8-22-90

ELEVATION: 3380.42
DISTANCE: 524.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] small CW. North of a log-jam.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	:.	.	:.									
DF	::											
ES	:.											
BI	.											
LF		.										
WWP	'											

TREE	DBH	HT	AGE	REMARKS
CW	7.1	22	12	Typical CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	[illegible]	4.8	2	Anma	1	Gnak-8	1	ROCK	–
Salix-1	:	–	1	Egar	1	Popa	1	B.G.	60
Cost	::	0.3	1	Somi	1	Prpv	1	LITTER	30
				Asmo	1			MOSS	10
				Neal				OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 26 DATE: 8-22-90

ELEVATION: 3379.09
DISTANCE: 540.1
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Channel shelf [illegible] in elevation [illegible] almost a small shallow wide gully on the channel shelf

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			21	21								
ES												
DF												

TREE*	DBH	HT	AGE	REMARKS:
CW	3.5	26	13	Typical CW of 3-5"
CW	1.7	20	10	" " of 1-3"

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet) 4	COVER CLASS 5	GRASS FORB	COVER CLASS 6	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		1.8	2	Egar	1	Gumb-4	1	ROCK	-
Sysl		0.0	1	Mespn	1	Gumb	1	B.G.	90
Salix-6		2.5	3	Somi	1			LITTER	5
								MOSS	2
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 27 DATE: 8-22-90

ELEVATION: 3379.60
DISTANCE: 556.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
In wide shallow gully - only trees are seedlings mostly wide open w/ Gumb-9 & 1-2' [illegible] w/ sandy

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE*	DBH	HT	AGE	REMARKS:
				All CW too young to age (i.e. too small)

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet) 4	COVER CLASS 5	GRASS FORB	COVER CLASS 6	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		1.9	2	AsFo	1	Gumb-8	2	ROCK	-
Salix-3		0.0	1	Egar	2			B.G.	85
Salix-6		1.7	2					LITTER	5
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 28 DATE: 8-22-90

ELEVATION: 3380.39
DISTANCE: 572.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Up out of shallow wide gully - hardly any [illegible] - surrounded by small CW (1-3" dbh) to 25' tall

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE*	DBH	HT	AGE	REMARKS:
				All CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet) 4	COVER CLASS 5	GRASS FORB	COVER CLASS 6	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1		0.0	1	Egar	1	Phpr	1	ROCK	-
				Meal	1	Gumb-8	1	B.G.	90
				AsFo	1			LITTER	5
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM 143

TRANSECT NUMBER: 5 OBSERVER: Woodsell
PLOT NUMBER: 29 DATE: 8-22-90

ELEVATION: 3380.50
DISTANCE: 589.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
In area of [illegible] young stand of CW and lots of grass. This plot still relatively open w/ few CW

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0-0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		6	3	2								
ES												

TREE*	DBH	HT	AGE	REMARKS:
CW	2.2	20	10	Typical of 1-3" class

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet) 4	COVER CLASS 5	GRASS FORB	COVER CLASS 6	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost		0.0	2	Somi	2	Gumb-4	1	ROCK	-
				AsFo	1	Gumb-1	1	B.G.	85
				Meal	1	Gumb-8	1	LITTER	5
				Egar	1			MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodwell
PLOT NUMBER: 30 DATE: 8-27-90

ELEVATION: 3390.60
DISTANCE: 605.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 75 sand 25 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: In a stand of 1-7" cw ≈ 20-25' tall w/ lots of orchard grass & white sweet clover.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	• 1	⊠· 11	⊠:: 4 2	:: 2 -	• 3							

TREE	DBH	HT	AGE	REMARKS
cw	5.1	33	19	lgst. cw
cw	3.2	25	13	Typical of most in stand.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	::	0.3	1	Meal	1	Dagl	3	ROCK	-
Rowo	:	0.0	1					B.G.	55
Sali. a	·	0.0	1					LITTER	25
Salix-4	·	0.0	1					MOSS	10
Salix-5	·	0.0	1					OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodwell
PLOT NUMBER: 31 DATE: 8-22-90

ELEVATION: 3379.65
DISTANCE: 622.1
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: Same as 5-30 - A few more willow & no Dactylis glomerata

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	::	46 live 14 [illegible]	⊠:	•								
WWP	•											
ES	≡											
DF	•											
BI	::											
SA	•											

TREE	DBH	HT	AGE	REMARKS
cw	2.1	23	9	typical cw
cw	3.5	29	16	lgst. cw

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	:·	0.0	1	As fo	2	Gramk-A	1	ROCK	-
Amal	·	0.0	1	Trifolium	1	Gramk-B	2	B.G.	75
Cost	⊡	0.0	1	Eqar	1	Phpr	1	LITTER	10
Salix-7	·	0.0	1	Cirsium	1			MOSS	-
Rupa		0.0	1	Meal	1			OTHER	-
Alte		0.0							

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodwell
PLOT NUMBER: 32 DATE: 8-27-90

ELEVATION: 3390.01
DISTANCE: 638.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS: On edge of small CW stand - small opening w/ a couple CW & several lg. [illegible] w/ lots of Poa + Phleum

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	•			• 2 -								
ES	⊠											
WWP	•											
SA	11											
DF	·											
BI	•											

TREE	DBH	HT	AGE	REMARKS
CW	3.7	24	14	lgst. CW in stand - only CW
ES	-	7.2	7	2 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rupa	⊠ 11	1.0	1	As fo	3	Pnpr	1	ROCK	-
Alte	::	13.2	4	As me	1	Popr	2	B.G.	-
Cost	⊠	0.2	1			Gramk-6	3	LITTER	50
Saex	:	0.7	1			Gramk-8	1	MOSS	-
Salix-6	=	0.0	2			Gramk-4	1	OTHER	-
Remy	·	0.0	1						
Rowo	⊠	0.0	2						
Syal	·	0.0	1						
Amal	·	0.0							

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Woodwell
PLOT NUMBER: 33 DATE: 8-22-90

ELEVATION: 3380.61
DISTANCE: 655.1
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

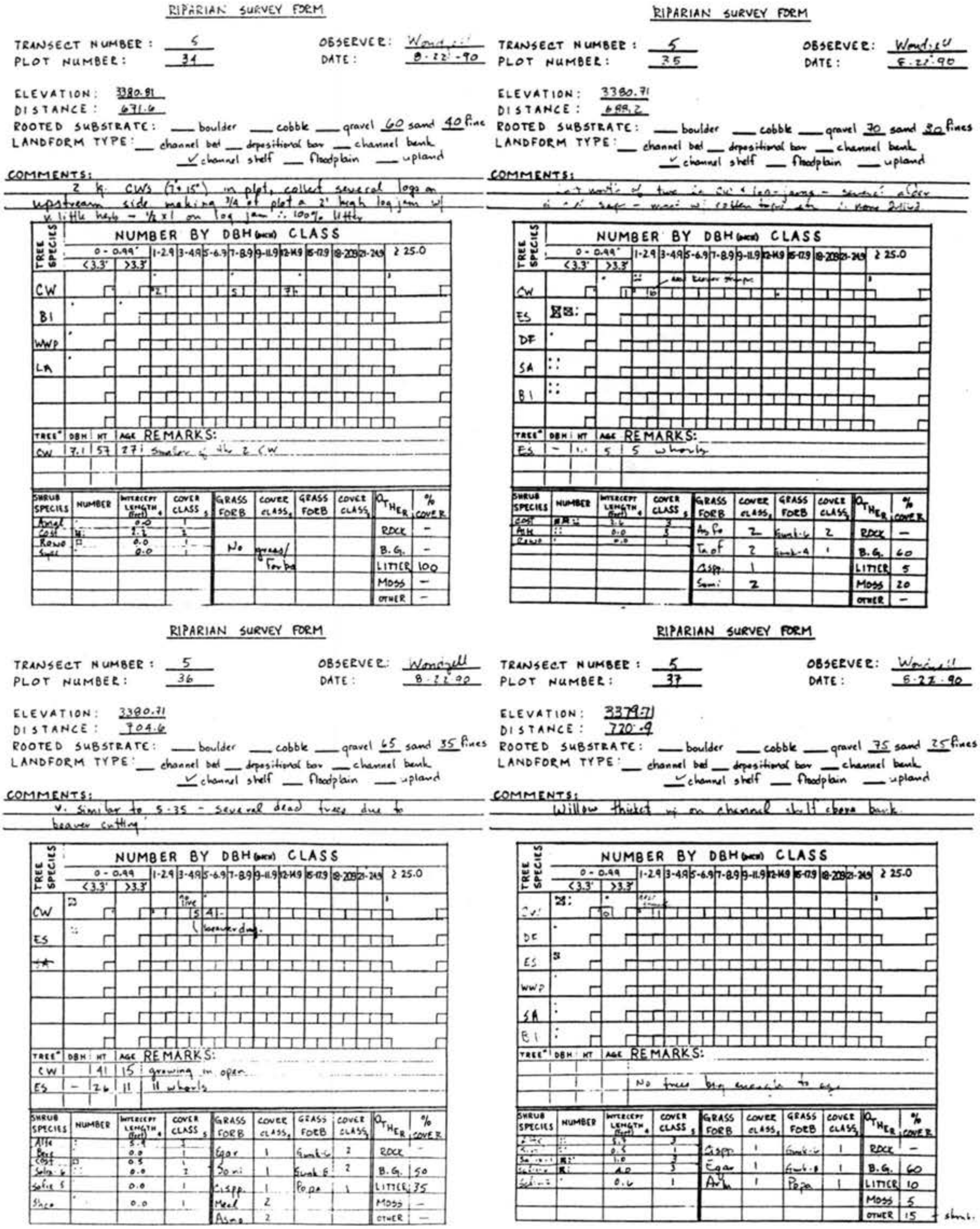
COMMENTS: In opening w/ v. little veg mostly Meal & Gramk-B & Phpr! No trees [illegible] for [illegible] seedlings. Small CW stand to south & lg. CW's & small log jam to north

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	:											
SF	:											
DF	:											
ES	=											

TREE	DBH	HT	AGE	REMARKS
ES	-	1.5	6	Ave. spruce

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rowo	⊠ 1	0.4	1	Gaar	1	Gramk-B	2	ROCK	-
Salix-?	·	0.0	1	Meal	1	Gramk-6	1	B.G.	85
Rupa	·	0.0	1			Phpr	1	LITTER	5
Cost	:	0.0	1					MOSS	-
								OTHER	-

Figure 43. Continued.



RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 34 DATE: 8-22-90

ELEVATION: 3380.81
DISTANCE: 671.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fine
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
2 lg. CWs (7+15") in plot, collect several logs on upstream side making 3/4 of plot a 2' high log jam w/ v. little herb – 1/2 x1 on log jam ∴ 100% litter

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW			2			5		7				
BI												
WWP												
LA												

TREE	DBH	HT	AGE	REMARKS
CW	7.1	57	27	smaller of the 2 CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Amal		0.0	1					ROCK	–
Cost		1.1	1						
Rowo		0.0	1	No grass/forbs				B.G.	–
Syal		0.0						LITTER	100
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 35 DATE: 8-22-90

ELEVATION: 3380.71
DISTANCE: 688.2
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
[illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW				10 (and beaver stumps)								
ES												
DF												
SA												
BI												

TREE	DBH	HT	AGE	REMARKS
ES	–	1.1	5	5 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost		3.6	3	Asfo	2	Grass-6	2	ROCK	–
Alin		0.0	3	Taof	2	Grass-4	1	B.G.	60
Rowo		0.0	1	Aspp.	1			LITTER	5
				Semi	2			MOSS	20
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 36 DATE: 8-22-90

ELEVATION: 3380.71
DISTANCE: 704.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
v. similar to 5-35 – several dead trees due to beaver cutting

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW				live 5	4 (beaver dmg.)							
ES												
SA												

TREE	DBH	HT	AGE	REMARKS
CW		41	15	growing in open
ES	–	26	11	11 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte		5.9	3						
Bere		0.0	1	Egar	1	Grass-6	2	ROCK	–
Cost		0.5	1						
Salix 6		0.0	1	Soni	1	Grass 6	2	B.G.	50
Salix 5		0.0	1	Cispp.	1	Popr	1	LITTER	35
Shca		0.0	1	Meal	2			MOSS	–
				Asmo	2			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5 OBSERVER: Wondzell
PLOT NUMBER: 37 DATE: 8-22-90

ELEVATION: 3379.71
DISTANCE: 720.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 75 sand 25 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Willow thicket w/ on channel shelf above bank.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		10										
DF												
ES												
WWP												
SA												
BI												

TREE	DBH	HT	AGE	REMARKS
				No trees big enough to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]		5.9	3						
[illegible]		0.5	1	Cispp.	1	Grass-6	1	ROCK	–
[illegible]		1.0	3						
[illegible]		4.0	3	Egar	1	Grass-8	1	B.G.	60
[illegible]		0.6	1	Arlu	1	Popr	1	LITTER	10
								MOSS	5
								OTHER	15 + shrub.

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 38
OBSERVER: Wardell
DATE: 8-22-90

ELEVATION: 3379.41
DISTANCE: 737.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar 1/2 channel bank 1/2 channel shelf ___ floodplain ___ upland

COMMENTS:
On rt. side of island or left bank of side channel 4' bank w/ 2-3' tall willow - all veg up on bank - bank 2' vertical gently sloping for next 2' vertical up to stake

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	[illegible]											

TREE #	DBH	HT	AGE	REMARKS:
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix 6	[illegible]	0.5	2	Eqar	2	Gnaph. sp	1	ROCK	—
Salix 1	[illegible]	1.2	2	Ci spp	2			B.G.	80
Salix 7	[illegible]	1.1	3	Trifolium	1			LITTER	5
Alte	:	0.4	1					MOSS	—
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 39
OBSERVER: Wardell
DATE: 8-22-90

ELEVATION: 3375.01
DISTANCE: 754.0
ROOTED SUBSTRATE: ___ boulder ___ cobble 50 gravel 25 sand 25 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
In bottom of side channel - gravel bed [illegible] in sand/fines - No veg. in it

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE #	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	50
No Shrubs				No	grass/forb			B.G.	50
								LITTER	—
								MOSS	—
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 40
OBSERVER: Wardell
DATE: 8-22-90

ELEVATION: 3374.41
DISTANCE: 770.4
ROOTED SUBSTRATE: ___ boulder ___ cobble 50 gravel 25 sand 25 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Same as 5-39 - No veg

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	trees											

TREE #	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	25
No shrubs				No grass/forbs				B.G.	75
								LITTER	—
								MOSS	—
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 41
OBSERVER: Wardell
DATE: 8-22-90

ELEVATION: 3373.91
DISTANCE: 786.8
ROOTED SUBSTRATE: ___ boulder 10 cobble 40 gravel 25 sand 25 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Same as 5-39, 5-40, plot extends to base of right bank -

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99 <3.3'	0 - 0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No	Trees											

TREE #	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	50
No shrubs				No grass/forb				B.G.	50
								LITTER	—
								MOSS	—
								OTHER	—

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 42

OBSERVER: Wondzell
DATE: 8-22-90

ELEVATION: 3380.21
DISTANCE: 803.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 40 sand 60 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ½ channel bank ___ channel shelf ___ floodplain ½ upland

COMMENTS:
Right bank of side channel, ½ plot = bank + other ½ to hillslope [illegible] - large shrubs + dense understory

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												1 *30.7" dbh
DF	⁙											
SA	:											

TREE*	DBH	HT	AGE	REMARKS:
ES	30.7	142	110+	110 years @ 0.95' - as far as borer can go.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	⁙	4.5	3	Fune-5	1	Pora	2	ROCK	–
Rowo	⁙	3.3	3	Amar	1	Cam-1	2	B.G.	25
Crdo	•	0.0	2	Aufo	2	Gram-4	2	LITTER	50
Acgl	:	1.1	2					MOSS	–
Smal	⁙	0.4	3					OTHER	–
Amal	⁙	1.7	2						
Shca	:	0.0	2						
Ri..	•	0.0	1						

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 5
PLOT NUMBER: 43

OBSERVER: Wondzell
DATE: 8-22-90

ELEVATION: 3387.41
DISTANCE: 820.1
ROOTED SUBSTRATE: ___ boulder ___ cobble 75 gravel 5 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ✓ upland

COMMENTS:
Upland / Hill slope - a lot of litter/om on top of gravel - packed w/ shrubs

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF	⁙											1 *26.2" DBH
ES	⁙											
SA	⁙			:								
Bl	•	•										

TREE*	DBH	HT	AGE	REMARKS:
DF	26.2	113	202	202 after 7.5" core. - older still

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	⁙	6.5	3	Frvi	1	Gaub-5	1	ROCK	–
Acgl	⁙	9.0	3			Com-1	2	B.G.	–
Ruin	⁙	0.0	1					LITTER	95
Syal	⁙	0.0	1					MOSS	–
Rowo	⁙	0.0	1					OTHER	–
Bere	⁙	0.1	1						
Rust	⁙	0.0	1						
Sh..	⁙	0.0	2						

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 1

OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3372.42
DISTANCE: 218.2
ROOTED SUBSTRATE: ___ boulder 10 cobble 50 gravel 40 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
sand/gravel/cobble bar w/ only 3-4' tall willows growing

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No Trees.												

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Sali-1	–	–	–					ROCK	20
Sali-3	⁙	4.3	4	No grass/forbs				B.G.	
Sali-2	⁙	0.2	3					LITTER	–
								MOSS	–
								OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 2

OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3374.52
DISTANCE: 234.7
ROOTED SUBSTRATE: ___ boulder 5 cobble 55 gravel 40 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
sand/gravel bar w/ 3-4' tall willows & 1 cw sapling

TREE SPECIES	0-0.99 <3.3'	0-0.99 >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	⁙	•										

TREE*	DBH	HT	AGE	REMARKS:
				Cw too small to core.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Sali-1	⁙	2.3	2					ROCK	40
Sali-3	:	0.0	2	No grass/forbs				B.G.	60
Sali-7	⁙	4.4	2					LITTER	–
Sali-6	:	1.4	2					MOSS	–
								OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 3
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3374.32
DISTANCE: 251.1
ROOTED SUBSTRATE: ___ boulder 5 cobble 80 gravel 15 sand ___ fines
LANDFORM TYPE: ___ channel bed ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: gravel/sand bar
No trees/shrubs/grass/forbs

NUMBER BY DBH (inch) CLASS (tree species: 0-0.99" <3.3' / >3.3', 1-2.9, 3-4.9, 5-6.9, 7-8.9, 9-11.9, 12-14.9, 15-17.9, 18-20.9, 21-24.9, ≥ 25.0): No trees

TREE* | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				No grass/forbs				ROCK	100
								B.G.	-
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 4
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3372.32
DISTANCE: 267.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: 1/3 channel bed ___ depositional bar ✓ channel bank (2/3) ___ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] bank of side channel, stake in middle of bank, 1/3 of plot in channel & under water.

NUMBER BY DBH (inch) CLASS: CW :

TREE* | DBH | HT | AGE | REMARKS: CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix [illegible]	:·	0.0	1	Egar		Gunk-8	1	ROCK	2
Sali[illegible]	·	0.0	1			Gunk-1	1	B.G.	97
								LITTER	-
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 5
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3364.82
DISTANCE: 283.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Side channel, entire plot under water, no trees, no shrubs, no forbs

NUMBER BY DBH (inch) CLASS: No trees

TREE* | DBH | HT | AGE | REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				No forb/grass				ROCK	
								B.G.	100
								LITTER	
								MOSS	
								OTHER	

—100

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 6
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3370.52
DISTANCE: 300.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] bank of side channel, stake @ the water's edge. [illegible] bank [illegible] 3-5' tall willows w Egar, Gunk-9, [illegible] - several small cw seedlings - Most cw seedlings start 1.5' above the stake.

NUMBER BY DBH (inch) CLASS: CW [illegible]

TREE* | DBH | HT | AGE | REMARKS: all CW too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix [illegible]	[illegible]	3.0	2	Egar	2			ROCK	5
Salix [illegible]	:	0.0	1					B.G.	90
Salix [illegible]	-	-	-					LITTER	-
								MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 7 DATE: 8-21-90

ELEVATION: 3375.02
DISTANCE: 316.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ✓ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: [illegible] channel - entire plot is the bank - mostly shrubs + CW seedlings

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	⊠::											

TREE	DBH	HT	AGE	REMARKS:
				All too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Crdo	:	0.0	1	Asmo	1	Gunk-8	1	ROCK	–
Amal	◻	0.4	1	Chle	1	Papr	1	B.G.	2
Attc	·	0.0	1	Meof	1			LITTER	95
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 8 DATE: 8-21-90

ELEVATION: 3374.72
DISTANCE: 333.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: On top of island now - [illegible] ES, DF + CW trees, some litter. Mostly all Meof w/ a little Gunk-4

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
LA								1				
SA			1									

TREE	DBH	HT	AGE	REMARKS:
LA	12.4	80	172	Only 2 trees in the plot. - LA extremely old for this size (168 + 177)
SA	2.4	15	35	
				- both growing at top edge of [illegible] bank

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	:	0.0	1	Meof	3	Gunk-4	1	ROCK	–
Rowo	:	0.0	1					B.G.	10
Syal	::	0.0	1					LITTER	75
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 9 DATE: 8-21-90

ELEVATION: 3374.72
DISTANCE: 344.60
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 90 sand 10 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: On top of island - mostly CW, ES + DF overstory, a few [illegible] - many shrubs + shrub spp

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW											1	
SA			1									
DF							1					

TREE	DBH	HT	AGE	REMARKS:
CW	22.8	125	[illegible]	See [illegible] - too hard to completely count
DF	10.7	65	[illegible]	Typical of trees w/in plot.
SA	2.8	20	[illegible]	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	::	0.0	2	Asfo	2	Gunk-4	1	ROCK	–
Amal	·	0.0	1	Lapa	3	Gunk-5	1	B.G.	2
Cost	⊠:	1.3	1						
Shca	·	0.0	1						
Bere	⊔	0.8	1					LITTER	80
Rowo	⊠::	2.6	2					MOSS	–
Syal	◻	0.4	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 10 DATE: 8-21-90

ELEVATION: 3377.02
DISTANCE: 365.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf × floodplain ___ upland

COMMENTS: [illegible] litter covered ground with [illegible] mostly DF & ES overstory w/ CW [illegible] little understory

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA		2										
DF							1					
ES						1						

TREE	DBH	HT	AGE	REMARKS:
DF	9.0	45	119	
ES	8.1	60	101	slightly smaller than typical

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgl	2	0.0	1						
Amal	1	1.1	1					ROCK	—
Cost	13	0.0	1					B.G.	2
Rowo	7	0.4	1					LITTER	78
Bere	1	0.0	1					MOSS	20
Amal	1	0.0	1					OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Woodzell
PLOT NUMBER: 11 DATE: 8-21-90

ELEVATION: 3377.12
DISTANCE: 382.2
ROOTED SUBSTRATE: – boulder – cobble – gravel 30 sand 70 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank __ channel shelf X floodplain __ upland

COMMENTS: [illegible] gully/ravine/old channel [illegible] spruce/cw [illegible] a slight depression on top of island [illegible] the length of island [illegible] doesn't appear to have had any water in it for several years.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF				1								1
ES	2											
SA	2											

TREE	DBH	HT	AGE	REMARKS
DF	3.5	16	36	Has a dead top
SA		1.8	6	age by whorls
ES		2.4	11	

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Agal	::	0.0	1	Ca[illegible]	1	Asfo	1	ROCK	–
[illegible]	::	0.0	1	Sma[illegible]	1	Funk 7	1	B.G.	–
Amal	·	0.0	1	Gunk 4	1			LITTER	100
Shca	::	0.0	1	Gunk 3	1			MOSS	–
Cost	··	0.0	1	Egar	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Woodzell
PLOT NUMBER: 12 DATE: 8-21-90

ELEVATION: 3377.92
DISTANCE: 398.70
ROOTED SUBSTRATE: – boulder – cobble – gravel 50 sand 50 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank __ channel shelf X floodplain __ upland

COMMENTS: Last plot in tall trees of spruce - to edge of small opening leaving the lg. [illegible] ES/CW/DF.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	:·	·		2								1
DF							1					
SA	:·											

TREE	DBH	HT	AGE	REMARKS
ES	7.1	15	45	Smaller than most ES in the area
DF	20.0	62	96	Typical DF

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Acgr / Cost	B:: / ::	0.6 / 0.4	1 / 1	Funk 7	1			ROCK	–
Shca	··	0.0	1	Gunk 5	1			B.G.	1
E[illegible]	··	0.0	1	[illegible]	1			LITTER	90
[illegible]	:·	0.0	1	Asfo	1			MOSS	10
[illegible]	·	0.0	1	Gunk 1	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Woodzell
PLOT NUMBER: 13 DATE: 8-21-90

ELEVATION: 3377.72
DISTANCE: 415.10
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 50 sand 50 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank __ channel shelf ✓ floodplain __ upland

COMMENTS: Overstory of ES/CW [illegible] in a little clearing - [illegible] Grass + ES [illegible]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF			1									1
ES	⊠⊠:	⊠⊠										
SA	⊠	·		2								
CE	·											
LA		:·										

TREE	DBH	HT	AGE	REMARKS
SA	4.7	29	32 core	largest trees in plot
DF	1.0	14	19 core	
ES	0.9	6.0	16+	[illegible]

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
ROWO	[illegible]	0.3	1	EQAR	1	Funk-9	3	ROCK	0
Syal	[illegible]	·	1	Gunk 1-3	3			B.G.	0
[illegible]	··	·	1	Gunk 5	1			LITTER	10
ALTe	:·	1.9	2						
PAMY	·	·	1	Asfo	2			MOSS	75
[illegible]	·	1.7	1	CALE	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Woodzell
PLOT NUMBER: 14 DATE: 8-21-90

ELEVATION: 3378.82
DISTANCE: 431.60
ROOTED SUBSTRATE: __ boulder __ cobble __ gravel 50 sand 50 fines
LANDFORM TYPE: __ channel bed __ depositional bar __ channel bank __ channel shelf ✓ floodplain __ upland

COMMENTS: Still on island at [illegible] small meadow - No lg. trees mostly ES seedlings/saplings [illegible] up out of small old channel

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	::	⊠	1									1
SA	:											
LA	·											

TREE	DBH	HT	AGE	REMARKS
ES	1.8	10	16	Tallest spruce

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte	·	9.0	3	Chle	1	Gunk 1-3	2	ROCK	–
Rowo	::	0.0	1	Asfo	1	Gunk-6	2	B.G.	–
SaAx-5	··	0.0	1	Mespp.	1	Phpr	1	LITTER	60
				Gunk-4	1	Papa	2	MOSS	10
				Acmo	1			OTHER	

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: [illegible]
PLOT NUMBER: 15 DATE: [illegible]

ELEVATION: 3379.20
DISTANCE: 448.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf X floodplain ___ upland

COMMENTS: In small meadow - mostly grass & forbs, - some logs laying across plot -

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	•••		•					•				•

TREE	DBH	HT	AGE	REMARKS
				CW too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
COST	•	0.0	1	Meal	1	Gumk-8	1	ROCK	—
				Chle	3	Phpr	1	B.G.	10
				Egar	2	Gumk-4	1	LITTER	20
								MOSS	50
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: [illegible]
PLOT NUMBER: 16 DATE: 8-21-90

ELEVATION: 3378.40
DISTANCE: 464.6
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: log saw at base of a large DF - 4' tall debris pile - lots of [illegible] - a couple of ES + the 1 lg. DF.

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	••		•					••				•
SA		•										
DF									•			

TREE	DBH	HT	AGE	REMARKS
DF	15.9	67	82	
ES	–	3.0	9	9 whorls
SA	0.6	5.0	11	11 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	▢	0.0	2					ROCK	-
Pust	⊠	1.1	2						
Alte	•	0.0	1	No grass / Forbs				B.G.	-
								LITTER	100
								MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: [illegible]
PLOT NUMBER: 17 DATE: 8-21-90

ELEVATION: 3378.1
DISTANCE: 480.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: Still on log: [illegible] 3 lg DF lots of lg. organic matter & litter layer, v. few grasses or forbs

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	•••	••	•					•				•
SA		•										
WWP	•											

TREE	DBH	HT	AGE	REMARKS
ES	1.1	7	13	largest ES

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal	••••	0.2	1	Meal	1	Gumk-8	1	ROCK	—
Salix	•	0.0		Crspp	1	Gumk-7	1	B.G.	0
Aruv		0.0		Fumk-5	1			LITTER	95
Cost	•••	0.0	1	Fumk-6	1			MOSS	—
Gite	••	0.0						OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: [illegible]
PLOT NUMBER: 18 DATE: 8-21-90

ELEVATION: 3380.10
DISTANCE: 497.3
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS: In shadow of lg. DF's - mostly knapweed + ES [illegible] v. few grasses

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF			•					•		•		•
ES		•										
LA	•	•	•									
WWP	•											
SA	••••	•										
CW	•••											

TREE	DBH	HT	AGE	REMARKS
DF	18.7	82	74	v. similar to DF's [illegible]
ES	1.9	12	18	largest ES

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal	•••	0.0	1	Cere	2	Popr	1	ROCK	—
Amal	••••	0.0	1	Egar	1	Crspp	1	B.G.	-
Pspa	•	0.0	1	Mils	2			LITTER	70
				MeoF	2			MOSS	-
				AnFo	2			OTHER	—

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 19 DATE: 8-21-90

ELEVATION: 3379.9
DISTANCE: 513.90
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 65 sand 35 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Small opening mostly ES + SA regen - lots of thistle

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES												
SA												
CE												
WWP												

TREE*	DBH	HT	AGE	REMARKS
ES	2.3	20	16	largest Spruce

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
[illegible]	[illegible]	2.0	1	Cispp.	2	Gunk-3	1	ROCK	—
Rust	::	0.0	1	Mead	1	Gunk 8	2	B.G.	10
Cost	.	0.0	1	Meof	1	Gunk-A	1	LITTER	70
Syal	::	0.3	1	Funk-5	1			MOSS	—
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 20 DATE: 8-21-90

ELEVATION: 3380.4
DISTANCE: 529.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
On edge of small CW stand - mostly CW + thistle

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW												

TREE*	DBH	HT	AGE	REMARKS
CW	3.0	25	20	Typical CW

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rupa	:.	0.5	1	Acmi	1	Gunk	2	ROCK	—
Rust	::	0.0	1	Cispp.	3	Gunk-1	1	B.G.	—
Salix-5	.	0.0	1	Asfo	1	Gunk-A	2	LITTER	60
				Asmr	1	Phpr	1	MOSS	-
				Pcof	1	Lima	1	OTHER	

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 21 DATE: 8-21-90

ELEVATION: 3381.2
DISTANCE: 546.20
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
In small stand of CW - small sapling CW w/ lots of thistle + clover

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW		4	1	2		4						

TREE*	DBH	HT	AGE	REMARKS
CW	8.7	40	27	lrgst CW - rotten centers - still able to count
CW	3.7	27	14	Typical of small CW stand

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rupa	::	0.5	1	Cispp	1	Gunk-3	1	ROCK	—
Cost	:	0.0	1	Phpr	1			B.G.	—
Rust	::	0.4	1	Eqar	1			LITTER	90
Salix-5	.	2.3	3	Frvi	1			MOSS	—
Salix-1	:.	0.8	[illegible]	Funk-6	1			OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wondzell
PLOT NUMBER: 22 DATE: 8-21-90

ELEVATION: 3382.18
DISTANCE: 562.2
ROOTED SUBSTRATE: ___ boulder 15 cobble 80 gravel 5 sand ___ fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Small opening just outside small CW stand - Adjacent to an old, large (25") CW. Plot is almost all Gunk-7 Phpr + clover + knapweed

TREE SPECIES	0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA												

TREE*	DBH	HT	AGE	REMARKS
SA	0.2	4.0	11	11 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rust	1:	0.4	1	Ceve	3	Gunk-7	3	ROCK	—
Syal	..	0.0	1	Hespp	3	Phpr	1	B.G.	—
						Gunk-8	1	LITTER	70
								MOSS	—
								OTHER	—

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 23
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3382.41
DISTANCE: 578.7
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 80 sand 20 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Still on island - small opening - surrounded on 2 sides by 5-6" ES + SA trees & the other by the small CW stand - stake + 1/2 plot on old log jam

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA		•										

TREE*	DBH	HT	AGE	REMARKS:
SA	0.4	5.0	13	13 whorls

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Cost	::	0.0	1	Meof	2	Gunk-B	2	ROCK	–
Syal	:	0.0	1	Cispp.	2	Carex-1	3	B.G.	–
Rust	⊠⊠⊠	1.7	1	Funk-6	1			LITTER	65
Ripa	•	0.0	1					MOSS	5
Rowo	•	0.0	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 24
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3379.88
DISTANCE: 595.0
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Plot in small grassy opening bordered by ES + SA trees.

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	::					4						
ES	:·											
CW		•										

TREE*	DBH	HT	AGE	REMARKS:
ES	7.9	48	30	largest ES - typical of ES in this area.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Syal / Salix-1	⊠ / :	1.5 / 0.0	1	Cispp	2	Prpr	2	ROCK	–
Shca	:	0.0	1	Meof	2	Gunk-B	2	B.G.	–
Cost	:·	0.0	1	Asfo	2	Gunk-5	1	LITTER	40
Rowo	::	1.0	1	Eqar	1			MOSS	30
Salix-6	•	0.0	1	Asmo	1			OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 25
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3379.38
DISTANCE: 611.50
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Similar to 6-24 - alot more regen of ES + SA w/ lots of grass!!!

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	⊐					2						
ES	⊠::											
DF	•											
CW		•	dead •									

TREE*	DBH	HT	AGE	REMARKS:
SA	8.8	37	27	Typical SA

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Shca / Ripa	• / ···	0.0 / 0.4	1 / 1	Asfo	2	Gunk-B	3	ROCK	–
Cost	⊠::	2.2	2	Meal	1	Prpr	3	B.G.	–
Salix-4	:·	0.0	1	Somi	1	Fepa	2	LITTER	30
Salix-1 / Acgl	·· / ·	1.3 / 0.0	1 / 1			Gunk-9	2	MOSS	30
Alte	•	0.0	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 26
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3376.08
DISTANCE: 627.8
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ✓ floodplain ___ upland

COMMENTS:
Dropping down from high pt. of island out onto grassy CW/willow shelf w/ mostly ES seedlings. V. open w/ thick grass.

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	>3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	•	::										
ES	⊠::											
SA	⊏											
WWP	•											

TREE*	DBH	HT	AGE	REMARKS:
ES	–	3.0	9	9 whorls - largest whorl
SA	–	0.5	–	too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	⊠:	0.4	1	Meof	2	Brin	1	ROCK	–
Salix-6	•	0.0	1	Somi	2	Gunk-B	2	B.G.	50
Syal	•	0.0	1	Epan	1	Phpr	1	LITTER	30
				Asfo	1	Epan	1	MOSS	–
								OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wor[illegible]
PLOT NUMBER: 27 DATE: 8-21-90

ELEVATION: 3376.78
DISTANCE: 644.10
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 30 sand 70 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Dropped down 1.5' from last plot even more open - less ES - herb veg. less dense. Down off the island - gradual transition from floodplain to shelf - no ba[r]

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF	∴											
CW	·											

TREE*	DBH	HT	AGE	REMARKS:
				All trees too young to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	·	0.0	1	Sami	3	Gunk-6	2	ROCK	—
				Meal	2	Brin	1	B.G.	80
				Mullein	1	Phpr	1	LITTER	:
						Gunk-5	1	MOSS	—
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wor[illegible]
PLOT NUMBER: 28 DATE: 8-21-90

ELEVATION: 3377.68
DISTANCE: 660.40
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 50 sand 50 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
Completely away from island top community - getting into CW/willow community

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF	∵											
WWP	:											
CW	⊏	:										

TREE*	DBH	HT	AGE	REMARKS:
DF	-	10.9	3	Hard to count whorls
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	∵	0.0	1	Somi	3	Gunk-6	2	ROCK	-
Salix-6	:	0.0	1	Meal	2	Brin	1	B.G.	65
Syal	·	0.0	1	Taof	2			LITTER	15
				Cere	1			MOSS	-
								OTHER	-

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wor[illegible]
PLOT NUMBER: 29 DATE: 8-21-90

ELEVATION: 3376.38
DISTANCE: 676.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW/willow thicket for ½ of plot - the side channel side - other half mostly CW-grass - stake put in thicket much less herbaceous veg.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	⊠:	·										
SA	⊔											
CW	⊠⊐	⊓:	·									

TREE*	DBH	HT	AGE	REMARKS:
CW	1.4	16	8	Tallest CW - drilled @ base

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	⊏	4.5	3	Somi	2	Gunk-4	1	ROCK	—
Salix-6	⁞⁞	6.0	2	Asfo	1	Brin	1	B.G.	60
Syal	:	0.0	1					LITTER	30
								MOSS	-
								OTHER	—

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Word[illegible]
PLOT NUMBER: 30 DATE: 9-21-90

ELEVATION: 3376.18
DISTANCE: 693.70
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: ___ channel bar ___ depositional bar ___ channel bank ✓ channel shelf ___ floodplain ___ upland

COMMENTS:
CW-Willow thicket - v. few herb.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	:|											
SA	:											
CW	·	∵										

TREE*	DBH	HT	AGE	REMARKS:
				No CW lg. enough to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	⊠⊠·	8.8	5	Cispp.	1	Gunk-3	1	ROCK	—
Salix-1	∵	2.6	2	Egar	1	Brin	1	B.G.	50
Cost	∷	0.0	1	Asfo	1			LITTER	40
				Mespp.	1			MOSS	-
								OTHER	-

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wendzell
PLOT NUMBER: 31 DATE: 8-21-90

ELEVATION: 3376.38
DISTANCE: 709.40
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 60 sand 40 fines
LANDFORM TYPE: 1/2 channel bed ___ depositional bar 1/2 channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Side at top of left bank. bank 4' high + vertical - channel bed all silt + sand no veg. all veg. is on top of bank + back from channel.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
SA	[illegible] 11											
DF	.											
ES	[illegible]											
WWP												
CW		o	.									

TREE#	DBH	HT	AGE	REMARKS
CW	1.2	11	13	Only tree big enough to drill

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	[illegible]	1.3	2	Somi	1	Popa	2	ROCK	–
Salix-3	:	1.8	1	Asmo	1	Gnuk-3	2	B.G.	–
Salix-6	⁙	11.4	3	Pkspp	1	Popr	1	LITTER	70
Alte-Shca	.	[illegible]	1			Brin	1	MOSS	10
Cost	::	[illegible]	1					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wendzell
PLOT NUMBER: 32 DATE: 8-21-90

ELEVATION: 3372.28
DISTANCE: 725.5
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: In channel bed almost all sand + silt - active channel w/ creates island - no trees - only 1 small willow @ SE corner of plot

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE#	DBH	HT	AGE	REMARKS

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-5	.	0.0	1	Several (40) small				ROCK	–
				forbs (maybe Aster) 1/4"-				B.G.	100
				1/2" tall - can't identify				LITTER	–
				less than 1% cover				MOSS	–
				collected as FUNK-10				OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wendzell
PLOT NUMBER: 33 DATE: 8-21-90

ELEVATION: 3372.08
DISTANCE: 741.9
ROOTED SUBSTRATE: ___ boulder ___ cobble ___ gravel 70 sand 30 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: No veg except for tiny Funk-10.

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE#	DBH	HT	AGE	REMARKS

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
No shrubs				Funk-10	1			ROCK	–
				(35)	all 1/2" tall			B.G.	100
				Muspp	1			LITTER	–
				1/4" tall				MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wendzell
PLOT NUMBER: 34 DATE: 8-21-90

ELEVATION: 3371.18
DISTANCE: 758.3
ROOTED SUBSTRATE: ___ boulder 20 cobble 30 gravel 25 sand 25 fines
LANDFORM TYPE: ✓ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: at bottom of right bank of a depositional bar (No veg at all) forms a small cobble bar island in side channel

TREE SPECIES	0-0.99" <3.3'	0-0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

TREE#	DBH	HT	AGE	REMARKS

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (Feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
								ROCK	–
No shrubs				No	grass	/ forbs		B.G.	100
								LITTER	–
								MOSS	–
								OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wardell
PLOT NUMBER: 35 DATE: 8-21-90

ELEVATION: 3372.88
DISTANCE: 775.0
ROOTED SUBSTRATE: ___ boulder 40 cobble 10 gravel 20 sand 30 fines
LANDFORM TYPE: ___ channel bar ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Cobble bar in side channel – 3-4' tall willow w/ a few CW seeds/saps.

TREE SPECIES	0 - 0.99' <3.3'	0 - 0.99' >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	:		•									

NUMBER BY DBH (inch) CLASS

TREE*	DBH	HT	AGE	REMARKS:
CW	1.2	10	7	Only 1 lg enough to drill

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	⊓	1.2	1					ROCK	50
Salix-6	::	0.3	1	No grass	forb			B.G.	50
								LITTER	–
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wardell
PLOT NUMBER: 36 DATE: 8-21-90

ELEVATION: 3374.45
DISTANCE: 791.3
ROOTED SUBSTRATE: ___ boulder 20 cobble 20 gravel 30 sand 30 fines
LANDFORM TYPE: ___ channel bar ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Depositional bar w/ 3-4' willow + an occasional CW

TREE SPECIES	0 - 0.99' <3.3'	0 - 0.99' >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
CW	•											

NUMBER BY DBH (inch) CLASS

TREE*	DBH	HT	AGE	REMARKS:
				CW too small to age

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	•	0.0	1					ROCK	50
Salix-6	⊠ ⊔	6.8	3		NONE			B.G.	50
Salix-7	•	0.0	1					LITTER	–
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wardell
PLOT NUMBER: 37 DATE: 8-21-90

ELEVATION: 3374.08
DISTANCE: 807.7
ROOTED SUBSTRATE: ___ boulder 20 cobble 10 gravel 30 sand 40 fines
LANDFORM TYPE: ___ channel bar ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Depositional bar w/ willow – no CW – v. similar/identical to 6-36 – No other shrubs/trees/grass/forb other than willow.

TREE SPECIES	0 - 0.99' <3.3'	0 - 0.99' >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

NUMBER BY DBH (inch) CLASS

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-6	⊠:	6.5	3					ROCK	10
Salix-1	::	1.0	1	No grass	/ forbs			B.G.	90
								LITTER	–
								MOSS	–
								OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6 OBSERVER: Wardell
PLOT NUMBER: 38 DATE: 8-21-90

ELEVATION: 3372.98
DISTANCE: 823.6
ROOTED SUBSTRATE: ___ boulder 20 cobble 15 gravel 25 sand 40 fines
LANDFORM TYPE: ___ channel bar ✓ depositional bar ___ channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS: Depositional bar; cobble embedded in fines. Only 1 willow shrub – no other veg.

TREE SPECIES	0 - 0.99' <3.3'	0 - 0.99' >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
No trees												

NUMBER BY DBH (inch) CLASS

TREE*	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Salix-1	:	0.0	1					ROCK	50
				No forbs	/ grass			B.G.	50
				other	than a			LITTER	–
				30	trunk-10 w/			MOSS	–
				[illegible]				OTHER	–

Figure 43. Continued.

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 39
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3369.98
DISTANCE: 840.30
ROOTED SUBSTRATE: ___ boulder 5 cobble 10 gravel 25 sand 60 fines
LANDFORM TYPE: 1/2 channel bed ___ depositional bar 1/2 channel bank ___ channel shelf ___ floodplain ___ upland

COMMENTS:
Small channel on the right side of the island/depositional bar sitting in middle of the side channel. stake is in bottom of the channel = novegetation in the 1/2 x 1 m plot.

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0

TREE	DBH	HT	AGE	REMARKS:

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte	•	0.0	2					ROCK	50
				No	forbs/grass			B.G.	50
								LITTER	–
								MOSS	–
								OTHER	100% water

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 40
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3377.68
DISTANCE: 856.9
ROOTED SUBSTRATE: ___ boulder ___ cobble 30 gravel 40 sand 30 fines
LANDFORM TYPE: ___ channel bed ___ depositional bar 1/2 channel bank ___ channel shelf ___ floodplain 1/2 upland

COMMENTS:
On right bank of side channel - stake on top of bank - alluv. on top of bank, 6-8' vertical bank - slope of hillslope = 95% (~45°)

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
ES	:											
DF	:	•										
CE	•											

TREE	DBH	HT	AGE	REMARKS:
				No trees on plot.

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Alte Cost	[illegible]	14.0	3 5	Fuel-6	1	Popa	1	ROCK	10
Amal Rupa	[illegible]		2			Quak-6	1	B.G.	25
Safx-1	•		1					LITTER	50
Syal	::		1					MOSS	15
Rowo	[illegible]		2					OTHER	–

RIPARIAN SURVEY FORM

TRANSECT NUMBER: 6
PLOT NUMBER: 41
OBSERVER: Wondzell
DATE: 8-21-90

ELEVATION: 3385.18
DISTANCE: 873.2
ROOTED SUBSTRATE: ___ boulder 50 cobble 50 gravel ___ sand ___ fines
LANDFORM TYPE: ___ channel bed ___ depositional bar ___ channel bank ___ channel shelf ___ floodplain ✓ upland

COMMENTS:
Talus/Scree slope w/ Sapo + lots of shrubs

TREE SPECIES	NUMBER BY DBH (inch) CLASS 0 - 0.99" <3.3'	0 - 0.99" >3.3'	1-2.9	3-4.9	5-6.9	7-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-24.9	≥ 25.0
DF		[illegible]	[illegible]									
BI			[illegible]									
SA	•											

TREE	DBH	HT	AGE	REMARKS:
DF	1.4	9	18	largest DF
BI	1.1	14	15	Only Birch

SHRUB SPECIES	NUMBER	INTERCEPT LENGTH (feet)	COVER CLASS	GRASS FORB	COVER CLASS	GRASS FORB	COVER CLASS	OTHER	% COVER
Rupa Syal	[illegible]	0.0 2.8	2 2	Mespp	2	Popa	1	ROCK	50
Amal Alte	[illegible]	2.6 0.0	3 1	Buttercup	1	Quak-5	1	B.G.	30
Shca	[illegible]	4.5	2					LITTER	5
Cost Pamy	[illegible]	2.1	2 1					MOSS	
								OTHER	15

Figure 43. Continued.

APPENDIX E
TWINSPAN ANALYSIS

UNDERSTANDING TWINSPAN

TWINSPAN is a FORTRAN computer program that classifies or groups sample plots and species according to their ecological preferences. Species, or groups of species, with clear ecological preferences can often be used to identify particular environmental conditions (Hill 1979). In short, TWINSPAN is an effective tool which allows the user to objectively identify natural groupings of similar plots and/or species, as they are distributed along a perceived environmental gradient.

Theoretical Basis and Assumptions

Through repeated hierarchial dichotomization, TWINSPAN constructs a two-way classification table that exhibits the relation between species and samples by grouping species with similar distributions together and stands with similar compositions together. Stands or plots are first ordinated (referred to a the primary ordination) along a pattern or direction of variation in the data using the method of reciprocal averaging (Hill 1979). As described by Jongman et al. (1987), if an environmental variable and species abundance or composition parameters are measured at a number of different sites, each species' optimum or indicator value can be computed by averaging the values of the environmental variable over the sites in which the species occur. Or conversely, given each species' indicator value, the environmental variable at a site can be computed by averaging the indicator values of all species growing on the site. The average values or scores can then be used to re-arrange sites and species in a site-by-species table. If species exhibit a bell-shaped distribution across the environmental variable, the re-arranged table will have a diagonal structure. Applying this averaging process both ways in an iterative fashion (i.e., reciprocal averaging) may reveal an underlying environmental gradient. The process of reciprocal averaging can be described as follows (after Jongman et al. 1987):

1. Initially, arbitrary and unequal site scores (x_i) are assigned to each of the "m" sites.

2. Species scores (y_j) for each of the "n" species are computed by calculating the weighted average of the abundance parameters across all sites.

$$y_j = \frac{\sum_{i=1}^{m} x_i k_{ji}}{\sum_{i=1}^{m} k_{ji}} \qquad (11)$$

where: k_{ji} is the abundance value of species j at site i.

3. New site scores are then computed using the new species scores.

$$x_i = \frac{\sum_{j=1}^{n} k_{ji} y_j}{\sum_{j=1}^{n} k_{ji}} \qquad (12)$$

4. These new site scores are then used to compute new species scores, and so on, until the scores stabilize. Realize, however, that with each iteration the range of scores gets smaller and smaller due to repeated averaging. To avoid this problem, site scores are usually rescaled or standardized after the first iteration. Rescaling assigns values from 0 to 100 to each site; the site with the lowest score is assigned a value of 0 and the site with the highest score a value of 100, the remaining sites are valued in proportion to their scores after the first iteration. More commonly, however,

scores are standardized to mean 0 and variance 1. This requires finding the centroid, z, of the site scores:

$$z=\sum_{i=1}^{m} x_i k_{Ti}/k_{TT} \tag{13}$$

where: k_{Ti} = total of abundance scores for site i, and
k_{TT} = total of abundance scores for all sites.

5. Next, the dispersion of the site scores (s^2) about the centroid is computed from:

$$s^2=\sum_{i=1}^{m} k_{Ti}(x_i-z)^2/k_{TT} \tag{14}$$

6. Finally the new site score ($x_{i,new}$) is calculated from:

$$x_{i,new}=(x_{i,old}-z)/s \tag{15}$$

7. Steps 2 through 6 are repeated until the new site scores are sufficiently close to the site scores of the previous cycle (i.e., convergence). Note that once the scores stabilize, "s" equals the eigenvalue, or the maximized dispersion of the species scores on the ordered axis.

After stands are arranged along the primary ordered axis, it is divided at its middle to produce a crude, or unrefined, dichotomy. Differential species that have a preference for either the left or right side of this primary dichotomy are then identified. A differential species is one with clear ecological preferences, whose presence often indicates a particular set of environmental conditions (Hill 1979). A second refined ordination is then made on the basis of these differential species. This refined ordination is used to determine or produce the desired dichotomy. TWINSPAN constructs a third and final ordination using a small number of the most strongly differential species. These highly preferential species and the final ordination are not used to actually determine the final dichotomy, but are provided as a convenience to the user as a succinct characterization of each division (Hill 1979).

Data Requirements

In the context of this study, TWINSPAN data requirements were relatively minor. Recall that TWINSPAN was used to objectively identify natural groupings of similar plots and/or species, as they are distributed along a perceived environmental gradient. Consequently, input data consisted of nothing more than the recorded abundance parameters (e.g., percent absolute cover, density, presence/absence) which described the species composition of each of the 198 surveyed plots. This information, taken from data collected on the Riparian Survey Forms (Appendix D), was directly input into the TWINSPAN program.

Model Input

Species abundance values measured at each site were entered manually into a two-dimensional data matrix. COMPOSE (Mohler 1987), a FORTRAN program developed for formatting and editing data matrices, was used to convert the data to TWINSPAN acceptable format. The data in Figure 44 is an example of a two-dimensional data array. The first line is essentially the title line, and the second is the FORTRAN format statement for inputing the site number, species number, species name, and respective abundance values. To conserve space, the data matrix has been divided into a series of columns (four per page) rather than the original, long continuous column. A single line of the continuous matrix would therefore consist of: a site number, species number, species name, and the three measured abundance parameters: density, presence/absence, and cover code.

```
 91 198 MFFR - DENSITY, PRESENCE/ABSENCE, COVER CLASS                TCMFFR**
(I3,I3,11X,F2.0)                                                      1
  1
  2
  3
  4
  5  8   ARIN  0 1 1
  5 11   ASFO  0 1 1
  5 21  CISPP  0 1 1
  5 78   SOCA  0 1 3
  5 23   COST  2 1 1
  5 25     CW 15 1 0
  6 11   ASFO  0 1 1
  6 38  GUNK1  0 1 1
  6 41  GUNK3  0 1 1
  6 82   TAOF  0 1 1
  6 23   COST  1 1 3
  6 25     CW 28 1 0
  7 11   ASFO  0 1 1
  7 41  GUNK3  0 1 1
  7 50   MEAL  0 1 1
  7 56   PHPR  0 1 1
  7 25     CW 45 1 0
  7 30     ES  1 1 0
  8 11   ASFO  0 1 3
  8 29   EQAR  0 1 1
  8 41  GUNK3  0 1 1
  8 25     CW 41 1 0
  8 30     ES  2 1 0
  8 23   COST  2 1 1
  8 62   ROWO  3 1 1
  8  3   ALTE  1 1 1
  9 11   ASFO  0 1 2
  9 38  GUNK1  0 1 1
  9 41  GUNK3  0 1 1
  9 56   PHPR  0 1 1
  9 23   COST  1 1 1
  9 25     CW 41 1 0
 10 41  GUNK3  0 1 1
 10 25     CW 33 1 0
 11 11   ASFO  0 1 1
 11 23   COST  1 1 1
 11 81   SYAL  1 1 1
 11 76   SHCA  1 1 1
 11  1   ACGL  1 1 1
 11 79   SPBE  1 1 1
 11 25     CW 20 1 0
 11 30     ES  4 1 0
 12 11   ASFO  0 1 3
 12  5   ANAR  0 1 1
 12 56   PHPR  0 1 1
 12 82   TAOF  0 1 1
 12 23   COST  7 1 1
 12 76   SHCA  1 1 1
 12  1   ACGL  2 1 1
 12  3   ALTE  1 1 1
 12 81   SYAL  1 1 1
 12 25     CW 46 1 0
 12 30     ES  8 1 0
 13 11   ASFO  0 1 3
 13 38  GUNK1  0 1 1
 13 41  GUNK3  0 1 1
 13 44  GUNK6  0 1 1
 13 52  MESPP  0 1 1
 13 82   TAOF  0 1 2
 13 23   COST  1 1 1
 13  3   ALTE  3 1 1
 13  1   ACGL  2 1 2
 13 76   SHCA  1 1 1
 13 25     CW 21 1 0
 13 30     ES 22 1 0
 13 27     DF  3 1 0
 13 48     LA  1 1 0
 14 12   ASMO  0 1 1
 14 20   CHLE  0 1 1
 14 31   FRVI  0 1 1
 14 41  GUNK3  0 1 1
 14 50   MEAL  0 1 1
 14  1   ACGL  2 1 2
 14 23   COST  1 1 1
 14 25     CW  9 1 0
 14 30     ES  3 1 0
 14 27     DF  1 1 0
 14 14     BI  1 1 0
 14 48     LA  2 1 0
 15 11   ASFO  0 1 1
 15 38  GUNK1  0 1 1
 15 76   SHCA  2 1 1
 15 79   SPBE  1 1 1
 15 66SALIX1   3 1 4
 15 25     CW 10 1 0
 15 30     ES  1 1 0
 16 11   ASFO  0 1 1
 16 20   CHLE  0 1 1
 16 21  CISPP  0 1 1
 16 66SALIX1   4 1 2
 16 67SALIX2   2 1 3
 16 68SALIX3   3 1 2
 16 69SALIX4   1 1 1
 16 23   COST  8 1 1
 17 29   EQAR  0 1 1
 17 66SALIX1   3 1 3
 17 68SALIX3   3 1 1
 17 69SALIX4   8 1 5
 17 23   COST 46 1 2
 18 66SALIX1   5 1 4
 18 68SALIX3   4 1 1
 18 69SALIX4   4 1 3
 18 23   COST 13 1 1
 19  1   ACGL  3 1 1
 19  4   AMAL  1 1 1
 19 23   COST 31 1 3
 19 66SALIX1   1 1 1
 19 68SALIX3   2 1 1
 19 63   RUPA 27 1 2
 19 74   SARA 43 1 2
 19 81   SYAL 51 1 2
 19 41  GUNK3  0 1 1
 19 44  GUNK6  0 1 1
 19 21  CISPP  0 1 1
 20 65     SA  1 1 0
 20 79   SPBE  2 1 1
 20 23   COST  2 1 1
 20 74   SARA 38 1 3
 20 81   SYAL 45 1 3
 20 13   BERE  2 1 1
 20 63   RUPA 32 1 2
 20  1   ACGL  3 1 1
 20  4   AMAL  8 1 2
 20 76   SHCA  1 1 1
 20 11   ASFO  0 1 2
 20 45  GUNK7  0 1 1
 21 30     ES  4 1 0
 21 48     LA  2 1 0
 21 65     SA  7 1 0
 21 88    WWP  1 1 0
 21 27     DF  4 1 0
 21 74   SARA 51 1 3
 21 81   SYAL 27 1 3
 21 62   ROWO  8 1 2
 21 63   RUPA 25 1 2
 21 23   COST  4 1 2
 21  1   ACGL 16 1 4
 21  4   AMAL  3 1 1
 21  5   ANAR  0 1 2
 21 11   ASFO  0 1 1
 21 22   CLCO  0 1 2
 21 31   FRVI  0 1 1
 21 41  GUNK3  0 1 2
 22 27     DF  4 1 0
 22 30     ES  1 1 0
 22 65     SA  4 1 0
 22 81   SYAL 17 1 2
 22 74   SARA 25 1 2
 22 63   RUPA 27 1 3
 22  4   AMAL  1 1 1
 22  1   ACGL 13 1 3
 22 62   ROWO  2 1 1
 22 69SALIX4   1 1 1
 22 21  CISPP  0 1 1
 22 31   FRVI  0 1 1
 22 38  GUNK1  0 1 2
 22 42  GUNK4  0 1 2
 22 45  GUNK7  0 1 2
 22 56   PHPR  0 1 1
 22 57   POPA  0 1 1
 23 30     ES  1 1 0
 23 27     DF  3 1 0
 23 65     SA  1 1 0
 23 69SALIX4   1 1 1
 23 23   COST  5 1 1
 23 81   SYAL 15 1 2
 23 63   RUPA 16 1 2
 23 74   SARA  7 1 1
 23  6   ANMA  0 1 1
 23 21  CISPP  0 1 2
 23 45  GUNK7  0 1 3
 24 65     SA  2 1 0
 24  1   ACGL  8 1 4
 24 74   SARA 62 1 3
 24 63   RUPA 35 1 3
 24 23   COST  1 1 1
 24 81   SYAL 12 1 2
 24  7   ARCO  0 1 1
 24 21  CISPP  0 1 1
 24 29   EQAR  0 1 1
 24 31   FRVI  0 1 1
 24 44  GUNK6  0 1 1
 24 77   SMRA  0 1 2
 24 83   THOC  0 1 1
 25 30     ES  2 1 0
 25 27     DF  3 1 0
 25 65     SA  7 1 0
 25 74   SARA 16 1 2
 25 54   OPHO 12 1 3
 25 66SALIX1   1 1 1
 25  1   ACGL  5 1 3
 25 81   SYAL  1 1 1
 25 62   ROWO  1 1 1
 25 63   RUPA 16 1 3
 25 26   DAGL  0 1 1
 25 29   EQAR  0 1 1
 25 60   PTAQ  0 1 1
 25 77   SMRA  0 1 2
 25 83   THOC  0 1 1
 26 25     CW 35 1 0
 26 30     ES  2 1 0
 26  3   ALTE  1 1 1
 26 11   ASFO  0 1 4
 26  2   ACMI  0 1 1
 26 29   EQAR  0 1 1
 26 46  GUNK8  0 1 1
 26 56   PHPR  0 1 1
 26 82   TAOF  0 1 1
 27 25     CW 36 1 0
 27 11   ASFO  0 1 2
 27 52  MESPP  0 1 1
 27 44  GUNK6  0 1 1
 28 25     CW 55 1 0
 28 30     ES  1 1 0
 28 11   ASFO  0 1 3
 28 56   PHPR  0 1 1
 28 52  MESPP  0 1 1
 28 82   TAOF  0 1 1
 29 25     CW 64 1 0
 29 30     ES  3 1 0
 29 11   ASFO  0 1 3
 29  2   ACMI  0 1 2
 29 20   CHLE  0 1 1
 29 50   MEAL  0 1 1
 29 44  GUNK6  0 1 1
 30 25     CW 66 1 0
 30 30     ES 34 1 0
 30 27     DF  7 1 0
 30 48     LA  1 1 0
 30 88    WWP  1 1 0
 30 76   SHCA  2 1 1
 30 11   ASFO  0 1 2
 30 19   CERE  0 1 2
 30 20   CHLE  0 1 1
 30 50   MEAL  0 1 2
 30 56   PHPR  0 1 1
 30 46  GUNK8  0 1 1
 30 44  GUNK6  0 1 1
 31 25     CW 28 1 0
 31 30     ES 40 1 0
 31 27     DF 10 1 0
 31 88    WWP  3 1 0
 31 65     SA  2 1 0
 31 48     LA  6 1 0
 31 76   SHCA  1 1 1
 31 11   ASFO  0 1 1
 31 19   CERE  0 1 2
 31 20   CHLE  0 1 1
 31 50   MEAL  0 1 2
 31 46  GUNK8  0 1 1
 32 25     CW 36 1 0
 32 30     ES 17 1 0
 32 27     DF  9 1 0
 32 48     LA  3 1 0
 32 65     SA  3 1 0
 32 11   ASFO  0 1 1
 32 50   MEAL  0 1 2
 32 20   CHLE  0 1 1
 33 25     CW 21 1 0
 33 30     ES 20 1 0
 33 27     DF 17 1 0
 33 48     LA  1 1 0
 33 65     SA  4 1 0
 33 88    WWP  2 1 0
 33 11   ASFO  0 1 1
 33 50   MEAL  0 1 1
 33  2   ACMI  0 1 1
 33 82   TAOF  0 1 1
 33 46  GUNK8  0 1 1
 34 25     CW 47 1 0
 34 30     ES 97 1 0
 34 27     DF 16 1 0
 34 48     LA  4 1 0
 34 65     SA 11 1 0
 34 88    WWP  2 1 0
 34  1   ACGL  2 1 2
 34 23   COST  1 1 1
 34 79   SPBE  3 1 1
 34 11   ASFO  0 1 2
 34 20   CHLE  0 1 1
```

Figure 44. Two-dimensional data matrix input into COMPOSE. COMPOSE output served as TWINSPAN input data file.

35	25	CW	37	1	0
35	30	ES	62	1	0
35	27	DF	2	1	0
35	65	SA	7	1	0
35	48	LA	1	1	0
35	1	ACGL	3	1	1
35	3	ALTE	1	1	1
35	81	SYAL	1	1	1
35	76	SHCA	2	1	1
35	11	ASFO	0	1	1
35	19	CERE	0	1	1
35	50	MEAL	0	1	2
35	46	GUNK8	0	1	1
35	20	CHLE	0	1	1
35	82	TAOF	0	1	1
35	44	GUNK6	0	1	1
35	56	PHPR	0	1	1
35	57	POPA	0	1	1
36	25	CW	25	1	0
36	30	ES	141	1	0
36	27	DF	4	1	0
36	65	SA	12	1	0
36	88	WWP	2	1	0
36	23	COST	1	1	1
36	3	ALTE	1	1	1
36	81	SYAL	1	1	1
36	11	ASFO	0	1	1
36	82	TAOF	0	1	1
36	19	CERE	0	1	1
36	50	MEAL	0	1	1
36	43	GUNK5	0	1	1
37	25	CW	26	1	0
37	30	ES	67	1	0
37	27	DF	8	1	0
37	65	SA	12	1	0
37	88	WWP	4	1	0
37	48	LA	3	1	0
37	1	ACGL	1	1	1
37	81	SYAL	1	1	1
37	76	SHCA	1	1	1
37	11	ASFO	0	1	1
37	82	TAOF	0	1	1
37	52	MESPP	0	1	2
37	2	ACMI	0	1	1
38	25	CW	33	1	0
38	30	ES	29	1	0
38	27	DF	4	1	0
38	65	SA	8	1	0
38	88	WWP	3	1	0
38	48	LA	4	1	0
38	76	SHCA	1	1	1
38	52	MESPP	0	1	1
38	19	CERE	0	1	1
38	46	GUNK8	0	1	1
38	44	GUNK6	0	1	1
39	25	CW	47	1	0
39	30	ES	18	1	0
39	27	DF	4	1	0
39	65	SA	7	1	0
39	88	WWP	1	1	0
39	23	COST	1	1	1
39	4	AMAL	1	1	1
39	70	SALIX5	1	1	1
39	62	ROWO	1	1	1
39	11	ASFO	0	1	1
39	46	GUNK8	0	1	1
39	82	TAOF	0	1	1
39	52	MESPP	0	1	1
40	25	CW	36	1	0
40	30	ES	21	1	0
40	27	DF	7	1	0
40	65	SA	7	1	0
40	88	WWP	2	1	0
40	48	LA	1	1	0
40	1	ACGL	3	1	2
40	11	ASFO	0	1	1
40	50	MEAL	0	1	1
40	19	CERE	0	1	1
41	25	CW	21	1	0
41	30	ES	34	1	0
41	27	DF	4	1	0
41	65	SA	8	1	0
41	48	LA	1	1	0
41	1	ACGL	4	1	2
41	3	ALTE	1	1	1
41	70	SALIX5	1	1	1
41	63	RUPA	5	1	2
41	11	ASFO	0	1	1
41	50	MEAL	0	1	2
41	20	CHLE	0	1	2
41	82	TAOF	0	1	1
41	29	EQAR	0	1	1
41	56	PHPR	0	1	1
41	46	GUNK8	0	1	1
41	44	GUNK6	0	1	1
41	39	GUNK10	0	1	2
41	5	ANAR	0	1	1
42	25	CW	2	1	0
42	30	ES	4	1	0
42	1	ACGL	1	1	1
42	19	CERE	0	1	1
42	50	MEAL	0	1	2
42	46	GUNK8	0	1	1
42	56	PHPR	0	1	1
43	25	CW	8	1	0
43	30	ES	26	1	0
43	27	DF	1	1	0
43	65	SA	5	1	0
43	1	ACGL	2	1	1
43	50	MEAL	0	1	2
43	2	ACMI	0	1	1
43	19	CERE	0	1	1
43	82	TAOF	0	1	1
43	20	CHLE	0	1	1
43	11	ASFO	0	1	1
44	1	ACGL	4	1	2
44	4	AMAL	9	1	2
44	81	SYAL	48	1	3
44	74	SARA	4	1	1
44	63	RUPA	5	1	1
44	6	ANMA	0	1	1
44	21	CISPP	0	1	1
44	50	MEAL	0	1	2
44	38	GUNK1	0	1	1
44	43	GUNK5	0	1	1
44	46	GUNK8	0	1	3
44	44	GUNK6	0	1	3
44	56	PHPR	0	1	1
44	57	POPA	0	1	2
45	65	SA	1	1	0
45	1	ACGL	7	1	4
45	63	RUPA	20	1	2
45	81	SYAL	36	1	3
45	74	SARA	30	1	2
45	23	COST	3	1	1
45	29	EQAR	0	1	1
46	30	ES	1	1	0
46	65	SA	3	1	0
46	81	SYAL	32	1	4
46	74	SARA	23	1	4
46	1	ACGL	4	1	4
46	62	ROWO	6	1	1
46	23	COST	1	1	1
46	63	RUPA	17	1	2
46	4	AMAL	4	1	3
46	29	EQAR	0	1	1
46	33	FUNK3	0	1	1
46	34	FUNK4	0	1	1
46	40	GUNK12	0	1	1
47	25	CW	1	1	0
47	1	ACGL	4	1	1
47	23	COST	1	1	1
47	54	OPHO	5	1	2
47	74	SARA	31	1	3
47	81	SYAL	5	1	2
47	63	RUPA	13	1	2
47	4	AMAL	1	1	1
47	29	EQAR	0	1	1
47	85	URDI	0	1	3
47	77	SMRA	0	1	2
47	34	FUNK4	0	1	1
48	65	SA	5	1	0
48	23	COST	2	1	1
48	54	OPHO	21	1	5
48	63	RUPA	7	1	2
48	74	SARA	13	1	2
48	1	ACGL	1	1	1
48	47	HELA	0	1	3
48	29	EQAR	0	1	2
48	83	THOC	0	1	1
48	85	URDI	0	1	1
48	40	GUNK12	0	1	1
48	41	GUNK3	0	1	1
48	45	GUNK7	0	1	1
49	65	SA	9	1	0
49	30	ES	2	1	0
49	1	ACGL	7	1	3
49	23	COST	4	1	4
49	54	OPHO	2	1	1
49	63	RUPA	6	1	1
49	64	RUST	3	1	1
49	29	EQAR	0	1	2
49	60	PTAQ	0	1	3
49	47	HELA	0	1	2
49	80	STAM	0	1	1
49	77	SMRA	0	1	1
49	43	GUNK5	0	1	1
49	40	GUNK12	0	1	1
49	41	GUNK3	0	1	1
49	17	CAREX1	0	1	3
49	38	GUNK1	0	1	1
50	30	ES	3	1	0
50	65	SA	4	1	0
50	1	ACGL	11	1	3
50	81	SYAL	1	1	1
50	54	OPHO	7	1	3
50	23	COST	2	1	1
50	64	RUST	4	1	1
50	63	RUPA	9	1	2
50	77	SMRA	0	1	1
50	29	EQAR	0	1	2
50	11	ASFO	0	1	1
50	21	CISPP	0	1	1
50	34	FUNK4	0	1	1
50	46	GUNK8	0	1	1
50	17	CAREX1	0	1	1
50	43	GUNK5	0	1	1
50	60	PTAQ	0	1	2
50	56	PHPR	0	1	1
51	30	ES	2	1	0
51	65	SA	4	1	0
51	81	SYAL	3	1	2
51	54	OPHO	5	1	2
51	63	RUPA	5	1	1
51	1	ACGL	9	1	2
51	23	COST	4	1	1
51	74	SARA	9	1	2
51	83	THOC	0	1	2
51	77	SMRA	0	1	3
51	29	EQAR	0	1	2
51	41	GUNK3	0	1	1
51	17	CAREX1	0	1	1
51	40	GUNK12	0	1	1
52	25	CW	11	1	0
52	69	SALIX4	1	1	1
52	46	GUNK8	0	1	2
53	25	CW	13	1	0
53	69	SALIX4	2	1	1
53	62	ROWO	20	1	1
53	43	GUNK5	0	1	1
53	78	SOCA	0	1	1
54	25	CW	13	1	0
54	69	SALIX4	1	1	1
54	62	ROWO	1	1	1
54	23	COST	1	1	1
54	1	ACGL	2	1	1
54	11	ASFO	0	1	1
55	25	CW	18	1	0
55	30	ES	8	1	0
55	65	SA	3	1	0
55	1	ACGL	3	1	1
55	3	ALTE	5	1	1
55	4	AMAL	6	1	1
55	23	COST	2	1	1
55	59	PRVI	2	1	1
55	78	SOCA	0	1	1
55	29	EQAR	0	1	1
55	41	GUNK3	0	1	1
56	25	CW	18	1	0
56	30	ES	16	1	0
56	65	SA	6	1	0
56	27	DF	2	1	0
56	88	WWP	1	1	0
56	1	ACGL	5	1	1
56	3	ALTE	5	1	1
56	4	AMAL	3	1	1
56	23	COST	4	1	1
56	11	ASFO	0	1	1
56	21	CISPP	0	1	1
56	41	GUNK3	0	1	1
56	52	MESPP	0	1	1
57	25	CW	14	1	0
57	30	ES	50	1	0
57	65	SA	16	1	0
57	27	DF	2	1	0
57	88	WWP	1	1	0
57	1	ACGL	3	1	1
57	3	ALTE	3	1	1
57	13	BERE	1	1	1
57	23	COST	3	1	1
57	63	RUPA	2	1	1
57	81	SYAL	1	1	1
57	11	ASFO	0	1	2
57	19	CERE	0	1	1
57	82	TAOF	0	1	2
57	56	PHPR	0	1	1
57	41	GUNK3	0	1	1
58	25	CW	10	1	0
58	30	ES	43	1	0
58	65	SA	14	1	0
58	27	DF	30	1	0
58	88	WWP	3	1	0
58	23	COST	3	1	1
58	4	AMAL	3	1	1
58	1	ACGL	4	1	1
58	81	SYAL	1	1	1
58	63	RUPA	5	1	1
58	11	ASFO	0	1	2
58	19	CERE	0	1	1
58	82	TAOF	0	1	2
58	52	MESPP	0	1	1
58	56	PHPR	0	1	1
58	41	GUNK3	0	1	1
59	25	CW	16	1	0
59	30	ES	24	1	0
59	65	SA	6	1	0
59	1	ACGL	5	1	1
59	4	AMAL	5	1	1
59	76	SHCA	3	1	1
59	11	ASFO	0	1	1

Figure 44. Continued.

59	44	GUNK6	0	1	1
60	25	CW	7	1	0
60	30	ES	77	1	0
60	65	SA	14	1	0
60	27	DF	2	1	0
60	88	WWP	6	1	0
60	1	ACGL	3	1	1
60	69	SALIX4	1	1	1
60	23	COST	1	1	1
60	59	PRVI	1	1	1
60	19	CERE	0	1	2
60	82	TAOF	0	1	2
60	50	MEAL	0	1	3
60	44	GUNK6	0	1	1
60	56	PHPR	0	1	1
60	46	GUNK8	0	1	1
61	25	CW	9	1	0
61	30	ES	120	1	0
61	65	SA	8	1	0
61	27	DF	4	1	0
61	48	LA	1	1	0
61	3	ALTE	1	1	1
61	11	ASFO	0	1	1
61	12	ASMO	0	1	1
61	19	CERE	0	1	2
61	20	CHLE	0	1	2
61	50	MEAL	0	1	2
61	44	GUNK6	0	1	1
61	46	GUNK8	0	1	1
61	56	PHPR	0	1	1
62	25	CW	15	1	0
62	30	ES	23	1	0
62	65	SA	2	1	0
62	27	DF	2	1	0
62	1	ACGL	1	1	1
62	11	ASFO	0	1	1
62	19	CERE	0	1	1
62	20	CHLE	0	1	1
62	50	MEAL	0	1	2
62	31	FRVI	0	1	1
62	46	GUNK8	0	1	1
63	25	CW	15	1	0
63	30	ES	27	1	0
63	65	SA	4	1	0
63	27	DF	7	1	0
63	14	BI	1	1	0
63	1	ACGL	1	1	1
63	3	ALTE	1	1	1
63	76	SHCA	1	1	1
63	81	SYAL	1	1	1
63	19	CERE	0	1	1
63	20	CHLE	0	1	1
63	31	FRVI	0	1	1
63	51	MEOF	0	1	1
63	46	GUNK8	0	1	1
63	56	PHPR	0	1	1
64	25	CW	16	1	0
64	30	ES	12	1	0
64	65	SA	1	1	0
64	14	BI	1	1	0
64	27	DF	1	1	0
64	1	ACGL	3	1	1
64	23	COST	1	1	1
64	20	CHLE	0	1	2
64	50	MEAL	0	1	2
64	82	TAOF	0	1	1
64	78	SOCA	0	1	1
64	56	PHPR	0	1	1
64	41	GUNK3	0	1	1
64	44	GUNK6	0	1	1
65	25	CW	1	1	0
65	30	ES	11	1	0
65	1	ACGL	2	1	1
65	4	AMAL	3	1	2
65	23	COST	5	1	3
65	74	SARA	4	1	1
65	63	RUPA	17	1	3
65	64	RUST	1	1	1
65	11	ASFO	0	1	1
65	78	SOCA	0	1	1
65	51	MEOF	0	1	2
65	50	MEAL	0	1	2
65	41	GUNK3	0	1	1
65	46	GUNK8	0	1	1
65	56	PHPR	0	1	1
66	30	ES	1	1	0
66	65	SA	2	1	0
66	1	ACGL	6	1	3
66	4	AMAL	5	1	2
66	63	RUPA	42	1	4
66	81	SYAL	43	1	3
66	74	SARA	33	1	3
66	64	RUST	4	1	1
66	23	COST	6	1	3
66	86	VAGL	1	1	1
66	70	SALIX5	1	1	1
66	61	RIIN	1	1	1
66	29	EQAR	0	1	1
66	77	SMRA	0	1	1
66	43	GUNK5	0	1	1
67	25	CW	1	1	0
67	30	ES	1	1	0
67	65	SA	1	1	0
67	14	BI	1	1	0
67	87	WH	3	1	0
67	54	OPHO	1	1	1
67	74	SARA	24	1	3
67	63	RUPA	33	1	3
67	81	SYAL	20	1	2
67	1	ACGL	6	1	5
67	4	AMAL	1	1	2
67	23	COST	5	1	2
67	64	RUST	1	1	1
67	61	RIIN	3	1	1
67	34	FUNK4	0	1	2
67	29	EQAR	0	1	2
68	30	ES	10	1	0
68	65	SA	7	1	0
68	63	RUPA	23	1	3
68	54	OPHO	12	1	4
68	81	SYAL	10	1	2
68	23	COST	6	1	4
68	1	ACGL	2	1	1
68	34	FUNK4	0	1	1
68	60	PTAQ	0	1	1
68	29	EQAR	0	1	1
68	75	SESE	0	1	1
69	30	ES	1	1	0
69	65	SA	6	1	0
69	61	RIIN	1	1	1
69	62	ROWO	1	1	1
69	63	RUPA	23	1	2
69	54	OPHO	17	1	3
69	81	SYAL	8	1	2
69	74	SARA	1	1	1
69	23	COST	7	1	3
69	1	ACGL	4	1	2
69	64	RUST	1	1	1
69	60	PTAQ	0	1	2
69	29	EQAR	0	1	2
69	75	SESE	0	1	3
69	47	HELA	0	1	2
69	38	GUNK1	0	1	1
69	17	CAREX1	0	1	3
69	57	POPA	0	1	1
69	43	GUNK5	0	1	1
69	45	GUNK7	0	1	1
69	40	GUNK12	0	1	1
70	30	ES	8	1	0
70	65	SA	5	1	0
70	64	RUST	3	1	1
70	1	ACGL	3	1	2
70	89	ACRU	2	1	1
70	81	SYAL	5	1	1
70	54	OPHO	14	1	2
70	61	RIIN	1	1	1
70	63	RUPA	11	1	2
70	62	ROWO	1	1	1
70	80	STAM	0	1	1
70	17	CAREX1	0	1	3
70	75	SESE	0	1	1
70	29	EQAR	0	1	1
70	60	PTAQ	0	1	2
70	40	GUNK12	0	1	1
71	30	ES	1	1	0
71	65	SA	3	1	0
71	14	BI	1	1	0
71	1	ACGL	3	1	3
71	74	SARA	57	1	4
71	63	RUPA	7	1	2
71	54	OPHO	11	1	2
71	81	SYAL	3	1	1
71	62	ROWO	4	1	1
71	33	FUNK3	0	1	2
71	75	SESE	0	1	1
71	29	EQAR	0	1	1
71	56	PHPR	0	1	1
71	57	POPA	0	1	1
71	17	CAREX1	0	1	3
71	45	GUNK7	0	1	1
71	43	GUNK5	0	1	1
71	38	GUNK1	0	1	1
72	25	CW	1	1	0
72	72	SALIX7	4	1	5
73	25	CW	1	1	0
74	25	CW	4	1	0
74	66	SALIX1	1	1	2
74	71	SALIX6	1	1	2
74	72	SALIX7	1	1	2
75	25	CW	11	1	0
75	71	SALIX6	1	1	1
75	72	SALIX7	1	1	1
76	25	CW	10	1	0
76	29	EQAR	0	1	1
77	25	CW	2	1	0
77	66	SALIX1	4	1	1
77	29	EQAR	0	1	1
77	42	GUNK4	0	1	1
78					
79					
80	25	CW	11	1	0
80	62	ROWO	14	1	2
80	81	SYAL	2	1	1
80	64	RUST	1	1	1
80	20	CHLE	0	1	2
80	84	SOCA	0	1	1
80	53	MULEIN	0	1	1
81	25	CW	1	1	0
81	62	ROWO	1	1	1
81	81	SYAL	6	1	1
81	11	ASFO	0	1	1
81	51	MEOF	0	1	2
81	21	CISPP	0	1	1
81	31	FRVI	0	1	1
81	12	ASMO	0	1	1
81	45	GUNK7	0	1	1
82	27	DF	1	1	0
82	81	SYAL	22	1	2
82	1	ACGL	2	1	1
82	62	ROWO	9	1	2
82	63	RUPA	1	1	1
82	11	ASFO	0	1	2
82	50	MEAL	0	1	3
82	15	BRIN	0	1	2
82	57	POPA	0	1	1
82	56	PHPR	0	1	1
83	25	CW	1	1	0
83	65	SA	14	1	0
83	62	ROWO	2	1	1
83	76	SHCA	2	1	1
83	1	ACGL	4	1	2
83	81	SYAL	4	1	2
83	13	BERE	6	1	1
83	23	COST	2	1	1
83	74	SARA	1	1	1
83	2	ACMI	0	1	2
83	21	CISPP	0	1	2
83	20	CHLE	0	1	3
83	50	MEAL	0	1	3
83	41	GUNK3	0	1	2
83	56	PHPR	0	1	2
83	46	GUNK8	0	1	1
84	30	ES	1	1	0
84	27	DF	1	1	0
84	65	SA	8	1	0
84	1	ACGL	5	1	1
84	76	SHCA	1	1	1
84	74	SARA	14	1	2
84	23	COST	9	1	2
84	81	SYAL	6	1	1
84	62	ROWO	2	1	1
84	11	ASFO	0	1	1
84	5	ANAR	0	1	1
84	21	CISPP	0	1	1
84	44	GUNK6	0	1	3
84	56	PHPR	0	1	1
84	43	GUNK5	0	1	1
84	17	CAREX1	0	1	2
85	25	CW	1	1	0
85	30	ES	3	1	0
85	27	DF	2	1	0
85	1	ACGL	1	1	1
85	23	COST	1	1	1
85	29	EQAR	0	1	1
85	21	CISPP	0	1	1
85	43	GUNK5	0	1	1
86	30	ES	2	1	0
86	27	DF	1	1	0
86	65	SA	1	1	0
86	1	ACGL	3	1	1
86	23	COST	1	1	1
86	81	SYAL	1	1	1
87	30	ES	6	1	0
87	65	SA	1	1	0
87	1	ACGL	2	1	1
87	81	SYAL	4	1	1
87	23	COST	3	1	1
87	76	SHCA	1	1	1
87	62	ROWO	1	1	1
87	29	EQAR	0	1	2
87	11	ASFO	0	1	1
87	41	GUNK3	0	1	1
88	30	ES	18	1	0
88	65	SA	9	1	0
88	18	CE	1	1	0
88	81	SYAL	15	1	2
88	62	ROWO	9	1	2
88	63	RUPA	8	1	1
88	3	ALTE	1	1	1
88	55	PAMY	5	1	1
88	61	RIIN	1	1	1
88	1	ACGL	5	1	1
88	23	COST	2	1	2
88	21	CISPP	0	1	1
88	5	ANAR	0	1	1
88	60	PTAQ	0	1	1
88	29	EQAR	0	1	1
88	17	CAREX1	0	1	2
88	41	GUNK3	0	1	2
88	43	GUNK5	0	1	1

Figure 44. Continued.

89 48 LA 1 1 0
89 30 ES 16 1 0
89 65 SA 5 1 0
89 70SALIX5 1 1 1
89 63 RUPA 5 1 1
89 23 COST 1 1 1
89 1 ACGL 1 1 1
89 81 SYAL 5 1 1
89 62 ROWO 4 1 1
89 20 CHLE 0 1 3
89 78 SOCA 0 1 1
89 11 ASFO 0 1 1
89 51 MEOF 0 1 1
89 50 MEAL 0 1 1
89 46 GUNK8 0 1 3
89 42 GUNK4 0 1 1
89 56 PHPR 0 1 1
89 43 GUNK5 0 1 1
89 29 EQAR 0 1 1
90 30 ES 1 1 0
90 23 COST 1 1 1
90 78 SOCA 0 1 2
90 50 MEAL 0 1 2
90 20 CHLE 0 1 1
90 21 CISPP 0 1 1
90 42 GUNK4 0 1 2
90 56 PHPR 0 1 2
90 46 GUNK8 0 1 2
90 44 GUNK6 0 1 2
91 30 ES 11 1 0
91 25 CW 3 1 0
91 65 SA 4 1 0
91 70SALIX5 1 1 1
91 64 RUST 1 1 1
91 81 SYAL 1 1 1
91 23 COST 1 1 1
91 3 ALTE 2 1 2
91 1 ACGL 1 1 1
91 4 AMAL 1 1 1
91 31 FRVI 0 1 1
91 56 PHPR 0 1 1
91 11 ASFO 0 1 1
91 29 EQAR 0 1 1
91 51 MEOF 0 1 1
91 21 CISPP 0 1 1
92 30 ES 48 1 0
92 25 CW 3 1 0
92 65 SA 2 1 0
92 14 BI 1 1 0
92 76 SHCA 1 1 1
92 74 SARA 1 1 1
92 3 ALTE 1 1 1
92 1 ACGL 2 1 1
92 23 COST 2 1 1
92 35 FUNK5 0 1 2
92 82 TAOF 0 1 1
92 29 EQAR 0 1 1
93 30 ES 9 1 0
93 64 RUST 1 1 1
93 70SALIX5 2 1 1
93 23 COST 1 1 1
93 74 SARA 1 1 1
93 81 SYAL 1 1 1
93 63 RUPA 1 1 1
93 29 EQAR 0 1 1
93 35 FUNK5 0 1 1
93 41 GUNK3 0 1 1
94 30 ES 6 1 0
94 65 SA 1 1 0
94 88 WWP 1 1 0
94 14 BI 1 1 0
94 23 COST 7 1 3
94 64 RUST 7 1 1
94 62 ROWO 2 1 1
94 63 RUPA 1 1 1
94 41 GUNK3 0 1 3
94 43 GUNK5 0 1 1
94 56 PHPR 0 1 1
95 30 ES 1 1 0
95 14 BI 1 1 0
95 3 ALTE 2 1 1
95 62 ROWO 22 1 3
95 64 RUST 8 1 1
95 63 RUPA 16 1 2
95 23 COST 9 1 4
95 1 ACGL 1 1 1
95 21 CISPP 0 1 1
95 20 CHLE 0 1 1
95 29 EQAR 0 1 1
95 41 GUNK3 0 1 1
96 30 ES 1 1 0
96 23 COST 12 1 5
96 64 RUST 22 1 2
96 62 ROWO 1 1 1
96 63 RUPA 6 1 1
96 3 ALTE 1 1 1
96 81 SYAL 2 1 1
96 21 CISPP 0 1 1
96 29 EQAR 0 1 1
97 90 LP 1 1 0
97 30 ES 2 1 0
97 64 RUST 15 1 1
97 23 COST 5 1 4
97 63 RUPA 8 1 1
97 5 ANAR 0 1 1
97 21 CISPP 0 1 1
97 46 GUNK8 0 1 1
98 25 CW 2 1 0
98 23 COST 8 1 3
98 64 RUST 30 1 2
98 4 AMAL 1 1 1
98 63 RUPA 3 1 1
98 53MULEIN 0 1 2
98 57 POPA 0 1 1
98 29 EQAR 0 1 1
98 52 MESPP 0 1 1
99 25 CW 1 1 0
99 48 LA 1 1 0
99 23 COST 7 1 2
99 63 RUPA 4 1 1
99 64 RUST 5 1 1
99 29 EQAR 0 1 1
99 36 FUNK6 0 1 1
99 37 FUNK7 0 1 1
100 27 DF 1 1 0
100 30 ES 4 1 0
100 65 SA 3 1 0
100 18 CE 1 1 0
100 14 BI 1 1 0
100 25 CW 1 1 0
100 23 COST 10 1 2
100 3 ALTE 2 1 1
100 76 SHCA 1 1 1
100 81 SYAL 2 1 1
100 64 RUST 1 1 1
100 29 EQAR 0 1 2
100 43 GUNK5 0 1 1
100 21 CISPP 0 1 1
100 41 GUNK3 0 1 1
100 38 GUNK1 0 1 1
101 25 CW 1 1 0
101 3 ALTE 5 1 3
101 66SALIX1 5 1 2
101 68SALIX3 3 1 2
101 71SALIX6 10 1 3
101 23 COST 4 1 1
101 11 ASFO 0 1 1
101 12 ASMO 0 1 1
101 17CAREX1 0 1 1
101 44 GUNK6 0 1 2
102 25 CW 12 1 0
102 66SALIX1 4 1 1
102 67SALIX2 1 1 1
102 68SALIX3 14 1 3
102 71SALIX6 4 1 1
102 3 ALTE 15 1 2
102 23 COST 3 1 1
102 29 EQAR 0 1 1
103 25 CW 4 1 0
103 66SALIX1 18 1 3
103 67SALIX2 1 1 2
103 68SALIX3 6 1 4
103 71SALIX6 20 1 1
103 3 ALTE 3 1 1
103 23 COST 17 1 1
103 21 CISPP 0 1 1
103 29 EQAR 0 1 1
103 52 MESPP 0 1 1
103 36 FUNK6 0 1 1
104 25 CW 9 1 0
104 14 BI 1 1 0
104 65 SA 1 1 0
104 66SALIX1 16 1 4
104 71SALIX6 17 1 3
104 23 COST 50 1 2
104 11 ASFO 0 1 1
104 38 GUNK1 0 1 1
104 41 GUNK3 0 1 3
104 44 GUNK6 0 1 2
105 25 CW 1 1 0
105 30 ES 2 1 0
105 65 SA 6 1 0
105 66SALIX1 3 1 2
105 69SALIX4 1 1 1
105 71SALIX6 8 1 2
105 62 ROWO 7 1 1
105 23 COST 81 1 5
105 78 SOCA 0 1 1
105 56 PHPR 0 1 1
105 38 GUNK1 0 1 2
105 43 GUNK5 0 1 1
105 44 GUNK6 0 1 1
105 46 GUNK8 0 1 2
105 15 BRIN 0 1 2
105 26 DAGL 0 1 1
106 25 CW 2 1 0
106 23 COST 47 1 2
106 66SALIX1 5 1 2
106 68SALIX3 14 1 3
106 69SALIX4 1 1 1
106 71SALIX6 4 1 2
106 72SALIX7 3 1 2
106 3 ALTE 1 1 1
106 29 EQAR 0 1 1
106 41 GUNK3 0 1 1
106 42 GUNK4 0 1 1
106 43 GUNK5 0 1 1
107 25 CW 9 1 0
107 66SALIX1 8 1 1
107 67SALIX2 3 1 1
107 68SALIX3 2 1 1
107 71SALIX6 23 1 4
107 72SALIX7 8 1 2
107 23 COST 4 1 1
107 63 RUPA 2 1 1
108 25 CW 9 1 0
108 30 ES 2 1 0
108 65 SA 2 1 0
108 27 DF 3 1 0
108 74 SARA 20 1 1
108 71SALIX6 15 1 2
108 63 RUPA 1 1 1
108 72SALIX7 1 1 1
108 66SALIX1 2 1 1
108 78 SOCA 0 1 1
108 46 GUNK8 0 1 3
109 65 SA 23 1 0
109 30 ES 33 1 0
109 88 WWP 2 1 0
109 27 DF 2 1 0
109 25 CW 4 1 0
109 1 ACGL 1 1 1
109 3 ALTE 3 1 1
109 23 COST 1 1 1
109 66SALIX1 19 1 3
109 71SALIX6 44 1 5
109 49 LAPA 0 1 1
109 78 SOCA 0 1 1
109 50 MEAL 0 1 1
109 29 EQAR 0 1 1
109 46 GUNK8 0 1 2
109 57 POPA 0 1 1
109 56 PHPR 0 1 1
109 43 GUNK5 0 1 1
109 44 GUNK6 0 1 1
110 25 CW 3 1 0
110 65 SA 2 1 0
110 71SALIX6 16 1 2
110 66SALIX1 2 1 1
110 3 ALTE 3 1 2
111
112
113 23 COST 38 1 3
113 3 ALTE 4 1 3
113 63 RUPA 22 1 2
113 62 ROWO 31 1 2
113 81 SYAL 22 1 3
113 71SALIX6 3 1 3
113 4 AMAL 1 1 1
113 29 EQAR 0 1 2
113 77 SMRA 0 1 2
113 21 CISPP 0 1 1
113 37 FUNK7 0 1 1
114 30 ES 1 1 0
114 3 ALTE 2 1 2
114 63 RUPA 49 1 4
114 4 AMAL 11 1 2
114 81 SYAL 43 1 3
114 23 COST 1 1 1
114 1 ACGL 1 1 1
114 29 EQAR 0 1 1
114 11 ASFO 0 1 1
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116
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119
120 32FUNK10 0 1 1
121 32FUNK10 0 1 1
121 21 CISPP 0 1 1
122 32FUNK10 0 1 1
122 84TRIFOL 0 1 1
123
124
125 29 EQAR 0 1 1
125 32FUNK10 0 1 1
126 29 EQAR 0 1 1
126 32FUNK10 0 1 1
127 29 EQAR 0 1 1
128 72SALIX7 1 1 1
128 32FUNK10 0 1 1
129 25 CW 18 1 0
129 66SALIX1 9 1 2
129 68SALIX3 2 1 2
129 71SALIX6 12 1 3
129 72SALIX7 18 1 3
129 9 ARLU 0 1 1
129 78 SOCA 0 1 1
130 25 CW 17 1 0
130 66SALIX1 37 1 4

Figure 44. Continued.

130	72SALIX7	5	1	2
130	29 EQAR	0	1	1
130	57 POPA	0	1	1
130	11 ASFO	0	1	1
130	12 ASMO	0	1	1
130	42 GUNK4	0	1	1
130	46 GUNK8	0	1	1
131	25 CW	14	1	0
131	66SALIX1	8	1	3
131	68SALIX3	1	1	1
131	71SALIX6	10	1	3
131	72SALIX7	4	1	1
131	11 ASFO	0	1	1
131	38 GUNK1	0	1	3
131	44 GUNK6	0	1	1
131	46 GUNK8	0	1	1
132	25 CW	7	1	0
132	88 WWP	1	1	0
132	3 ALTE	3	1	2
132	66SALIX1	6	1	3
132	68SALIX3	1	1	1
132	71SALIX6	10	1	3
132	29 EQAR	0	1	1
132	57 POPA	0	1	1
133	25 CW	13	1	0
133	88 WWP	2	1	0
133	30 ES	3	1	0
133	27 DF	1	1	0
133	65 SA	1	1	0
133	66SALIX1	8	1	4
133	68SALIX3	1	1	1
133	71SALIX6	13	1	3
133	72SALIX7	3	1	1
133	76 SHCA	1	1	2
133	1 ACGL	2	1	1
133	50 MEAL	0	1	2
133	82 TAOF	0	1	1
133	41 GUNK3	0	1	1
134	30 ES	26	1	0
134	88 WWP	2	1	0
134	27 DF	2	1	0
134	25 CW	4	1	0
134	65 SA	3	1	0
134	3 ALTE	3	1	2
134	23 COST	3	1	1
134	66SALIX1	20	1	1
134	68SALIX3	4	1	1
134	71SALIX6	22	1	3
134	50 MEAL	0	1	2
134	11 ASFO	0	1	1
134	78 SOCA	0	1	1
134	56 PHPR	0	1	1
134	46 GUNK8	0	1	2
135	30 ES	6	1	0
135	88 WWP	1	1	0
135	25 CW	6	1	0
135	65 SA	2	1	0
135	14 BI	2	1	0
135	48 LA	1	1	0
135	66SALIX1	3	1	2
135	68SALIX3	3	1	3
135	71SALIX6	12	1	4
135	3 ALTE	2	1	1
135	62 ROWO	4	1	1
135	52 MESPP	0	1	1
136	25 CW	2	1	0
136	14 BI	1	1	0
136	30 ES	3	1	0
136	65 SA	1	1	0
136	66SALIX1	6	1	2
136	68SALIX3	7	1	3
136	71SALIX6	6	1	2
136	3 ALTE	7	1	3
136	23 COST	1	1	1
136	62 ROWO	1	1	1
136	56 PHPR	0	1	1
136	29 EQAR	0	1	1
136	36 FUNK6	0	1	1
136	41 GUNK3	0	1	1
136	44 GUNK6	0	1	1
137	14 BI	1	1	0
137	30 ES	2	1	0
137	3 ALTE	1	1	1
137	66SALIX1	1	1	1
137	23 COST	3	1	1
137	71SALIX6	2	1	1
138	25 CW	10	1	0
138	30 ES	2	1	0
138	71SALIX6	11	1	3
138	23 COST	9	1	2
138	62 ROWO	11	1	3
138	61 RIIN	1	1	1
138	29 EQAR	0	1	1
138	41 GUNK3	0	1	1
139	25 CW	7	1	0
139	27 DF	4	1	0
139	30 ES	3	1	0
139	14 BI	1	1	0
139	48 LA	2	1	0
139	88 WWP	1	1	0
139	66SALIX1	2	1	1
139	71SALIX6	6	1	2
139	23 COST	5	1	1
139	6 ANMA	0	1	1
139	29 EQAR	0	1	1
139	78 SOCA	0	1	1
139	12 ASMO	0	1	1
139	50 MEAL	0	1	1
139	46 GUNK8	0	1	1
139	57 POPA	0	1	1
139	56 PHPR	0	1	1
140	25 CW	23	1	0
140	30 ES	5	1	0
140	27 DF	1	1	0
140	66SALIX1	92	1	2
140	71SALIX6	14	1	3
140	81 SYAL	1	1	1
140	29 EQAR	0	1	1
140	52 MESPP	0	1	1
140	78 SOCA	0	1	1
140	42 GUNK4	0	1	1
140	44 GUNK6	0	1	1
141	25 CW	17	1	0
141	66SALIX1	38	1	2
141	68SALIX3	8	1	1
141	71SALIX6	22	1	2
141	11 ASFO	0	1	1
141	29 EQAR	0	1	2
141	46 GUNK8	0	1	2
142	25 CW	4	1	0
142	66SALIX1	2	1	1
142	29 EQAR	0	1	1
142	50 MEAL	0	1	1
142	11 ASFO	0	1	1
142	56 PHPR	0	1	1
142	46 GUNK8	0	1	1
143	25 CW	15	1	0
143	30 ES	3	1	0
143	23 COST	7	1	2
143	78 SOCA	0	1	2
143	11 ASFO	0	1	1
143	50 MEAL	0	1	1
143	29 EQAR	0	1	1
143	38 GUNK1	0	1	1
143	42 GUNK4	0	1	1
143	46 GUNK8	0	1	1
144	25 CW	31	1	0
144	23 COST	4	1	1
144	62 ROWO	2	1	1
144	70SALIX5	1	1	1
144	50 MEAL	0	1	1
144	26 DAGL	0	1	3
145	25 CW	17	1	0
145	88 WWP	1	1	0
145	30 ES	6	1	0
145	27 DF	1	1	0
145	14 BI	4	1	0
145	65 SA	1	1	0
145	71SALIX6	3	1	1
145	72SALIX7	1	1	1
145	23 COST	8	1	1
145	4 AMAL	1	1	1
145	63 RUPA	1	1	1
145	3 ALTE	1	1	1
145	11 ASFO	0	1	2
145	84TRIFOL	0	1	1
145	29 EQAR	0	1	1
145	21 CISPP	0	1	1
145	50 MEAL	0	1	1
145	56 PHPR	0	1	1
145	42 GUNK4	0	1	1
145	46 GUNK8	0	1	2
146	25 CW	2	1	0
146	30 ES	9	1	0
146	88 WWP	1	1	0
146	65 SA	6	1	0
146	27 DF	1	1	0
146	14 BI	1	1	0
146	63 RUPA	16	1	1
146	3 ALTE	4	1	4
146	23 COST	9	1	1
146	74 SARA	2	1	1
146	71SALIX6	6	1	2
146	55 PAMY	1	1	1
146	62 ROWO	21	1	2
146	81 SYAL	1	1	1
146	4 AMAL	1	1	1
146	11 ASFO	0	1	3
146	12 ASMO	0	1	1
146	56 PHPR	0	1	1
146	57 POPA	0	1	2
146	42 GUNK4	0	1	1
146	44 GUNK6	0	1	3
146	46 GUNK8	0	1	1
147	25 CW	2	1	0
147	65 SA	2	1	0
147	27 DF	2	1	0
147	30 ES	6	1	0
147	71SALIX6	1	1	1
147	23 COST	2	1	1
147	63 RUPA	1	1	1
147	62 ROWO	20	1	1
147	29 EQAR	0	1	1
147	50 MEAL	0	1	1
147	44 GUNK6	0	1	1
147	46 GUNK8	0	1	2
147	56 PHPR	0	1	1
148	25 CW	3	1	0
148	14 BI	2	1	0
148	88 WWP	1	1	0
148	48 LA	1	1	0
148	4 AMAL	1	1	1
148	23 COST	12	1	2
148	62 ROWO	8	1	1
148	81 SYAL	1	1	1
149	25 CW	6	1	0
149	30 ES	22	1	0
149	27 DF	1	1	0
149	65 SA	4	1	0
149	14 BI	14	1	0
149	23 COST	25	1	3
149	3 ALTE	4	1	3
149	62 ROWO	1	1	1
149	11 ASFO	0	1	2
149	82 TAOF	0	1	2
149	78 SOCA	0	1	2
149	42 GUNK4	0	1	1
149	44 GUNK6	0	1	2
150	25 CW	10	1	0
150	30 ES	4	1	0
150	3 ALTE	2	1	3
150	13 BERE	1	1	1
150	23 COST	8	1	1
150	71SALIX6	4	1	2
150	70SALIX5	1	1	1
150	76 SHCA	1	1	1
150	29 EQAR	0	1	1
150	78 SOCA	0	1	1
150	21 CISPP	0	1	1
150	50 MEAL	0	1	2
150	12 ASMO	0	1	2
150	44 GUNK6	0	1	2
150	46 GUNK8	0	1	2
150	58 POPR	0	1	1
150	57 POPA	0	1	1
151	25 CW	13	1	0
151	27 DF	1	1	0
151	30 ES	9	1	0
151	88 WWP	1	1	0
151	65 SA	2	1	0
151	14 BI	1	1	0
151	3 ALTE	4	1	3
151	81 SYAL	3	1	1
151	66SALIX1	13	1	3
151	71SALIX6	12	1	3
151	72SALIX7	1	1	1
151	21 CISPP	0	1	1
151	29 EQAR	0	1	1
151	9 ARLU	0	1	1
151	44 GUNK6	0	1	1
151	46 GUNK8	0	1	1
151	57 POPA	0	1	1
152	25 CW	9	1	0
152	71SALIX6	9	1	2
152	66SALIX1	25	1	2
152	72SALIX7	9	1	3
152	3 ALTE	2	1	1
152	29 EQAR	0	1	2
152	21 CISPP	0	1	2
152	84TRIFOL	0	1	1
152	46 GUNK8	0	1	1
153				
154				
155				
156	30 ES	1	1	0
156	27 DF	11	1	0
156	65 SA	2	1	0
156	23 COST	16	1	3
156	62 ROWO	69	1	3
156	24 CRDO	1	1	2
156	1 ACGL	1	1	2
156	81 SYAL	31	1	3
156	4 AMAL	9	1	2
156	76 SHCA	2	1	2
156	61 RIIN	1	1	1
156	35 FUNK5	0	1	1
156	5 ANAR	0	1	1
156	11 ASFO	0	1	2
156	57 POPA	0	1	2
156	17CAREX1	0	1	2
156	44 GUNK6	0	1	2
157	27 DF	9	1	0
157	30 ES	4	1	0
157	65 SA	14	1	0
157	14 BI	2	1	0
157	23 COST	11	1	3
157	1 ACGL	8	1	3
157	61 RIIN	3	1	1
157	81 SYAL	7	1	1
157	62 ROWO	4	1	1

Figure 44. Continued.

157	64	RUST	8	1	1
157	76	SHCA	3	1	2
157	3	ALTE	1	1	2
157	4	AMAL	1	1	1
157	31	FRVI	0	1	1
157	17	CAREX1	0	1	2
157	43	GUNK5	0	1	1
158	68	SALIX3	5	1	4
158	72	SALIX7	3	1	3
159	25	CW	4	1	0
159	66	SALIX1	3	1	2
159	68	SALIX3	2	1	2
159	71	SALIX6	2	1	2
159	72	SALIX7	3	1	2
160					
161	25	CW	2	1	0
161	66	SALIX1	1	1	1
161	71	SALIX6	3	1	1
161	29	EQAR		1	1
161	38	GUNK1		1	1
161	46	GUNK8		1	1
162					
163	25	CW	21	1	0
163	71	SALIX6	2	1	1
163	72	SALIX7	7	1	2
163	29	EQAR	0	1	2
164	25	CW	14	1	0
164	24	CRDO	2	1	1
164	4	AMAL	8	1	1
164	3	ALTE	1	1	1
164	12	ASMO	0	1	1
164	20	CHLE	0	1	1
164	51	MEOF	0	1	1
164	46	GUNK8	0	1	1
164	58	POPR	0	1	1
165	48	LA	1	1	0
165	65	SA	1	1	0
165	23	COST	2	1	1
165	62	ROWO	2	1	1
165	81	SYAL	4	1	1
165	51	MEOF	0	1	3
165	42	GUNK4	0	1	1
166	25	CW	2	1	0
166	65	SA	3	1	0
166	27	DF	1	1	0
166	1	ACGL	4	1	2
166	4	AMAL	1	1	1
166	23	COST	15	1	2
166	76	SHCA	1	1	1
166	13	BERE	7	1	1
166	62	ROWO	14	1	2
166	81	SYAL	8	1	1
166	11	ASFO	0	1	2
166	49	LAPA	0	1	3
166	42	GUNK4	0	1	1
166	43	GUNK5	0	1	1
167	65	SA	1	1	0
167	27	DF	1	1	0
167	30	ES	1	1	0
167	1	ACGL	2	1	1
167	81	SYAL	1	1	1
167	23	COST	13	1	1
167	62	ROWO	7	1	1
167	13	BERE	1	1	1
167	4	AMAL	1	1	1
168	27	DF	1	1	0
168	30	ES	2	1	0
168	65	SA	2	1	0
168	1	ACGL	4	1	1
168	62	ROWO	4	1	1
168	4	AMAL	1	1	1
168	76	SHCA	5	1	1
168	23	COST	2	1	1
168	21	CISPP	0	1	1
168	77	SMRA	0	1	1
168	42	GUNK4	0	1	1
168	29	EQAR	0	1	1
168	11	ASFO	0	1	1
168	37	FUNK7	0	1	1
169	30	ES	6	1	0
169	27	DF	1	1	0
169	65	SA	3	1	0
169	62	ROWO	14	1	2
169	23	COST	4	1	1
169	76	SHCA	2	1	1
169	61	RIIN	2	1	1
169	81	SYAL	3	1	1
169	63	RUPA	1	1	1
169	37	FUNK7	0	1	1
169	43	GUNK5	0	1	1
169	12	ASMO	0	1	1
169	11	ASFO	0	1	1
169	41	GUNK3	0	1	1
170	27	DF	1	1	0
170	30	ES	41	1	0
170	65	SA	11	1	0
170	18	CE	1	1	0
170	48	LA	3	1	0
170	62	ROWO	6	1	1
170	81	SYAL	6	1	1
170	69	SALIX4	2	1	1
170	3	ALTE	4	1	2
170	55	PAMY	1	1	1
170	23	COST	2	1	1
170	61	RIIN	1	1	1
170	63	RUPA	2	1	1
170	29	EQAR	0	1	1
170	41	GUNK3	0	1	3
170	43	GUNK5	0	1	1
170	11	ASFO	0	1	2
170	20	CHLE	0	1	1
170	91	FUNK9	0	1	3
171	30	ES	15	1	0
171	65	SA	2	1	0
171	48	LA	1	1	0
171	3	ALTE	1	1	3
171	62	ROWO	4	1	1
171	70	SALIX5	2	1	1
171	20	CHLE	0	1	1
171	11	ASFO	0	1	1
171	52	MESPP	0	1	1
171	42	GUNK4	0	1	1
171	12	ASMO	0	1	1
171	41	GUNK3	0	1	2
171	44	GUNK6	0	1	2
171	56	PHPR	0	1	1
171	57	POPA	0	1	2
172	25	CW	3	1	0
172	23	COST	1	1	1
172	50	MEAL	0	1	1
172	20	CHLE	0	1	3
172	29	EQAR	0	1	2
172	46	GUNK8	0	1	1
172	56	PHPR	0	1	1
172	42	GUNK4	0	1	1
173	30	ES	3	1	0
173	65	SA	1	1	0
173	27	DF	1	1	0
173	23	COST	8	1	2
173	64	RUST	14	1	2
173	3	ALTE	1	1	1
174	30	ES	6	1	0
174	65	SA	1	1	0
174	88	WWP	1	1	0
174	81	SYAL	4	1	1
174	71	SALIX6	1	1	1
174	10	ARUV	1	1	1
174	23	COST	3	1	1
174	3	ALTE	2	1	1
174	50	MEAL	0	1	1
174	35	FUNK5	0	1	1
174	36	FUNK6	0	1	1
174	45	GUNK7	0	1	1
174	46	GUNK8	0	1	1
175	27	DF	1	1	0
175	30	ES	1	1	0
175	48	LA	3	1	0
175	88	WWP	1	1	0
175	65	SA	5	1	0
175	25	CW	2	1	0
175	81	SYAL	3	1	1
175	4	AMAL	3	1	1
175	63	RUPA	1	1	1
175	19	CERE	0	1	2
175	29	EQAR	0	1	1
175	50	MEAL	0	1	2
175	51	MEOF	0	1	2
175	11	ASFO	0	1	2
175	58	POPR	0	1	1
175	21	CISPP	0	1	1
176	30	ES	3	1	0
176	65	SA	2	1	0
176	18	CE	1	1	0
176	88	WWP	1	1	0
176	63	RUPA	6	1	1
176	64	RUST	3	1	1
176	23	COST	1	1	1
176	81	SYAL	3	1	1
176	21	CISPP	0	1	2
176	50	MEAL	0	1	1
176	51	MEOF	0	1	1
176	35	FUNK5	0	1	1
176	41	GUNK3	0	1	1
176	44	GUNK6	0	1	1
176	46	GUNK8	0	1	2
177	25	CW	9	1	0
177	63	RUPA	5	1	1
177	64	RUST	4	1	1
177	70	SALIX5	1	1	1
177	2	ACMI	0	1	1
177	21	CISPP	0	1	3
177	11	ASFO	0	1	1
177	12	ASMO	0	1	1
177	51	MEOF	0	1	1
177	44	GUNK6	0	1	2
177	46	GUNK8	0	1	2
177	56	PHPR	0	1	1
177	6	ANMA	0	1	1
177	38	GUNK1	0	1	1
178	25	CW	22	1	0
178	63	RUPA	6	1	1
178	23	COST	2	1	1
178	64	RUST	4	1	1
178	70	SALIX5	1	1	3
178	66	SALIX1	3	1	1
178	21	CISPP	0	1	1
178	56	PHPR	0	1	1
178	29	EQAR	0	1	1
178	31	FRVI	0	1	1
178	36	FUNK6	0	1	1
178	41	GUNK3	0	1	1
179	65	SA	1	1	0
179	64	RUST	5	1	1
179	81	SYAL	3	1	1
179	19	CERE	0	1	3
179	52	MESPP	0	1	3
179	45	GUNK7	0	1	3
179	46	GUNK8	0	1	1
179	56	PHPR	0	1	1
180	65	SA	1	1	0
180	23	COST	6	1	1
180	81	SYAL	2	1	1
180	63	RUPA	1	1	1
180	64	RUST	29	1	1
180	62	ROWO	1	1	1
180	21	CISPP	0	1	2
180	36	FUNK6	0	1	1
180	46	GUNK8	0	1	2
180	17	CAREX1	0	1	3
181	65	SA	5	1	0
181	30	ES	3	1	0
181	25	CW	1	1	0
181	81	SYAL	11	1	3
181	66	SALIX1	1	1	1
181	76	SHCA	2	1	1
181	23	COST	3	1	1
181	62	ROWO	6	1	1
181	71	SALIX6	1	1	1
181	21	CISPP	0	1	2
181	51	MEOF	0	1	2
181	11	ASFO	0	1	2
181	29	EQAR	0	1	1
181	12	ASMO	0	1	1
181	56	PHPR	0	1	2
181	46	GUNK8	0	1	2
181	43	GUNK5	0	1	1
182	65	SA	8	1	0
182	30	ES	15	1	0
182	27	DF	1	1	0
182	25	CW	1	1	0
182	76	SHCA	1	1	1
182	63	RUPA	3	1	1
182	23	COST	14	1	2
182	69	SALIX4	3	1	1
182	66	SALIX1	2	1	1
182	1	ACGL	1	1	1
182	3	ALTE	1	1	1
182	11	ASFO	0	1	2
182	50	MEAL	0	1	1
182	78	SOCA	0	1	1
182	46	GUNK8	0	1	3
182	56	PHPR	0	1	3
182	57	POPA	0	1	2
183	25	CW	5	1	0
183	30	ES	14	1	0
183	65	SA	6	1	0
183	88	WWP	1	1	0
183	66	SALIX1	12	1	1
183	71	SALIX6	1	1	1
183	81	SYAL	1	1	1
183	51	MEOF	0	1	2
183	78	SOCA	0	1	2
183	28	EPAN	0	1	1
183	11	ASFO	0	1	1
183	15	BRIN	0	1	1
183	46	GUNK8	0	1	2
183	56	PHPR	0	1	1
183	29	EQAR	0	1	1
184	27	DF	3	1	0
184	25	CW	1	1	0
184	71	SALIX6	1	1	1
184	78	SOCA	0	1	3
184	50	MEAL	0	1	2
184	53	MULEIN	0	1	1
184	44	GUNK6	0	1	2
184	15	BRIN	0	1	1
184	56	PHPR	0	1	1
184	43	GUNK5	0	1	1
185	27	DF	3	1	0
185	88	WWP	2	1	0
185	25	CW	8	1	0
185	66	SALIX1	3	1	1
185	71	SALIX6	2	1	1
185	81	SYAL	1	1	1
185	78	SOCA	0	1	3
185	50	MEAL	0	1	2
185	82	TAOF	0	1	2
185	19	CERE	0	1	1
185	44	GUNK6	0	1	2
185	15	BRIN	0	1	1

Figure 44. Continued.

```
186 65       SA  7 1  0
186 25       CW 33 1  0
186 66SALIX1  8 1  3
186 71SALIX6  6 1  2
186 81    SYAL  2 1  1
186 11    ASFO  0 1  1
186 78    SOCA  0 1  2
186 42 GUNK4  0 1  1
186 15    BRIN  0 1  1
187 30       ES  5 1  0
187 65       SA  2 1  0
187 25       CW  6 1  0
187 71SALIX6 21 1  5
187 66SALIX1  3 1  2
187 23   COST  4 1  1
187 21 CISPP  0 1  1
187 29   EQAR  0 1  1
187 11    ASFO  0 1  1
187 52 MESPP  0 1  1
187 41 GUNK3  0 1  1
187 15    BRIN  0 1  1
188 65       SA 16 1  0
188 27       DF  2 1  0
188 30       ES 24 1  0
188 88      WWP  1 1  0
188 25       CW  4 1  0
188 66SALIX1  9 1  2
188 68SALIX3  2 1  1
188 71SALIX6 10 1  3
188  3    ALTE  1 1  2
188 76    SHCA  1 1  1
188 23    COST  4 1  1
188 78    SOCA  0 1  1
188 11    ASFO  0 1  1
188 52 MESPP  0 1  1
188 57    POPA  0 1  2
188 41 GUNK3  0 1  2
188 56    PHPR  0 1  1
188 15    BRIN  0 1  1
189 70SALIX5  1 1  1
189 32FUNK10  0 1  1
190 32FUNK10  0 1  1
190 52 MESPP  0 1  1
191
192 25       CW  4 1  0
192 66SALIX1  7 1  1
192 71SALIX6  4 1  1
193 25       CW  1 1  0
193 66SALIX1  1 1  1
193 71SALIX6 15 1  3
193 72SALIX7  1 1  1
194 66SALIX1  4 1  1
194 71SALIX6 13 1  3
195 66SALIX1  2 1  1
195 32FUNK10  0 1  1
196  3    ALTE  1 1  2
197 30       ES  2 1  0
197 27       DF  3 1  0
197 25       CW  1 1  0
197  3    ALTE  7 1  3
197 23    COST 20 1  5
197  4    AMAL  1 1  1
197 63    RUPA 12 1  1
197 66SALIX1  1 1  1
197 81    SYAL  4 1  1
197 62    ROWO  8 1  2
197 76    SHCA  1 1 1
197 36 FUNK6  0 1 1
197 57    POPA  0 1 1
197 44 GUNK6  0 1 1
198 27       DF  4 1 0
198 14       BI  1 1 0
198 65       SA  1 1 0
198 63    RUPA 18 1 2
198 81    SYAL 15 1 2
198  4    AMAL  5 1 3
198  3    ALTE  1 1 2
198 76    SHCA  5 1 2
198 23    COST  3 1 2
198 55    PAMY  1 1 1
198 52 MESPP  0 1 2
198 16BTRCUP  0 1 1
198 57    POPA  0 1 1
198 43 GUNK5  0 1 1
0

ACGL    ACMI    ALTE    AMAL    ANAR    ANMA    ARCO    ARIN    ARLU    ARUV
ASFO    ASMO    BERE    BI      BRIN    BTRCUP  CAREX1  CE      CERE    CHLE
CISPP   CLCO    COST    CRDO    CW      DAGL    DF      EPAN    EQAR    ES
FRVI    FUNK10  FUNK3   FUNK4   FUNK5   FUNK6   FUNK7   GUNK1   GUNK10  GUNK12
GUNK3   GUNK4   GUNK5   GUNK6   GUNK7   GUNK8   HELA    LA      LAPA    MEAL
MEOF    MESPP   MULEIN  OPHO    PAMY    PHPR    POPA    POPR    PRVI    PTAQ
RIIN    ROWO    RUPA    RUST    SA      SALIX1  SALIX2  SALIX3  SALIX4  SALIX5
SALIX6  SALIX7  SALIX8  SARA    SESE    SHCA    SMRA    SOCA    SPBE    STAM
SYAL    TAOF    THOC    TRIFOL  URDI    VAGL    WH      WWP     ACRU    LP
FUNK9
PLOT101 PLOT102 PLOT103 PLOT104 PLOT105 PLOT106 PLOT107 PLOT108 PLOT109 PLOT110
PLOT111 PLOT112 PLOT113 PLOT114 PLOT115 PLOT116 PLOT117 PLOT118 PLOT119 PLOT120
PLOT121 PLOT122 PLOT123 PLOT124 PLOT125 PLOT201 PLOT202 PLOT203 PLOT204 PLOT205
PLOT206 PLOT207 PLOT208 PLOT209 PLOT210 PLOT211 PLOT212 PLOT213 PLOT214 PLOT215
PLOT216 PLOT217 PLOT218 PLOT219 PLOT220 PLOT221 PLOT222 PLOT223 PLOT224 PLOT225
PLOT226 PLOT301 PLOT302 PLOT303 PLOT304 PLOT305 PLOT306 PLOT307 PLOT308 PLOT309
PLOT310 PLOT311 PLOT312 PLOT313 PLOT314 PLOT315 PLOT316 PLOT317 PLOT318 PLOT319
PLOT320 PLOT401 PLOT402 PLOT403 PLOT404 PLOT405 PLOT406 PLOT407 PLOT408 PLOT409
PLOT410 PLOT411 PLOT412 PLOT413 PLOT414 PLOT415 PLOT416 PLOT417 PLOT418 PLOT419
PLOT420 PLOT421 PLOT422 PLOT423 PLOT424 PLOT425 PLOT426 PLOT427 PLOT428 PLOT429
PLOT430 PLOT431 PLOT432 PLOT433 PLOT434 PLOT435 PLOT436 PLOT437 PLOT438 PLOT439
PLOT440 PLOT441 PLOT442 PLOT443 PLOT501 PLOT502 PLOT503 PLOT504 PLOT505 PLOT506
PLOT507 PLOT508 PLOT509 PLOT510 PLOT511 PLOT512 PLOT513 PLOT514 PLOT515 PLOT516
PLOT517 PLOT518 PLOT519 PLOT520 PLOT521 PLOT522 PLOT523 PLOT524 PLOT525 PLOT526
PLOT527 PLOT528 PLOT529 PLOT530 PLOT531 PLOT532 PLOT533 PLOT534 PLOT535 PLOT536
PLOT537 PLOT538 PLOT539 PLOT540 PLOT541 PLOT542 PLOT543 PLOT601 PLOT602 PLOT603
PLOT604 PLOT605 PLOT606 PLOT607 PLOT608 PLOT609 PLOT610 PLOT611 PLOT612 PLOT613
PLOT614 PLOT615 PLOT616 PLOT617 PLOT618 PLOT619 PLOT620 PLOT621 PLOT622 PLOT623
PLOT624 PLOT625 PLOT626 PLOT627 PLOT628 PLOT629 PLOT630 PLOT631 PLOT632 PLOT633
PLOT634 PLOT635 PLOT636 PLOT637 PLOT638 PLOT639 PLOT640 PLOT641
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Figure 44. Continued.

For example, " 5 23 COST 2 1 1 " , implies: site number 5, species number 23, species code COST which represents Cornus stolonifera, density equal to 2 plants per plot, a 1 indicates it was present, and finally, a cover code equal to 1. Figure 44 therefore, illustrates the input data for all 198 sample plots. This data matrix was then converted into TWINSPAN acceptable format using the COMPOSE FORTRAN program. Altering the FORTRAN format statement on the second line, permitted separate runs to be conducted on each individual abundance parameter.

Model Calibration and Sensitivity Analysis

No model calibration or sensitivity analysis was required. Standard TWINSPAN analysis was conducted on all species and plots across the six vegetation transects. Standard analysis implies that all parameters were set to the default values as outlined in Hill (1979). The only exception was that a species must have occurred in more than 5 plots to be included in each analysis, and plots that contained no species (i.e., barren of vegetation or completely inundated at time of sampling) were excluded from the analysis. Separate analyses were conducted on: presence/absence values associated with all 91 species, density values for all shrub and tree species, and percent absolute cover values for all shrub and herbaceous species.

Model Output

As an example of TWINSPAN output, Figure 45 presents output from the analysis conducted on the presence/absence values for all species. The first part of the output merely echoes the input data matrix and input parameters. Note that by including only those species that were present in at least 5 plots, and by excluding those plots which contained no species, this analysis was limited to 57 species and 175 plots.

Following the input parameters, the output displays the eigenvalue, indicator species (together with their sign), and preferential species associated with each dichotomy. The bulk of the output is comprised of this type of information for each subsequent division. Note that only the first two divisions were really used to identify the four cover types described earlier. The first division distinguished 35 plots that were essentially willow dominated. Positive indicator species associated with this dichotomy were Salix 1, Salix 6, and Salix 7. Subsequent division of this group provided no additional information other than to further distinguish the willow species from all other species (Division 3). Division of the remaining 140 species (Division 2) identified two distinct groups: one characterized by spruce (ES), fir (SA), false raspberry (RUPA), and common snowberry (SYAL), and the other dominated by cottonwood (CW), white sweet-clover (MEAL), and leafy aster (ASFO). The fourth division seemed to have identified another potential cover type; one characterized by Douglas' fir (DF), Wood's rose (ROWO), and buffaloberry (SHCA). These species tend to be more tolerant of drier sites than do spruce, fir, false raspberry, and common snowberry. Yet closer inspection of the data revealed no noticeable pattern in the occurrence and distribution of these species or groups of species. Similarly, subsequent divisions failed to provide additional insight into interpreting the ecological significance of any particular dichotomy or sample set. They are included here, however, as part of the complete output of a typical TWINSPAN analysis.

The final product of the TWINSPAN analysis is an ordered, two-way site-by-species classification table which typically arrays species and stands in a diagonal structure. This diagonal structure often reflects an underlying environmental gradient. Two-way site by species classification tables for TWINSPAN analyses on presence/absence values of all species, density values for all tree and shrub species, and percent absolute cover values for all shrub and herbaceous species, are presented in Figures 46, 47, and 48, respectively. Recognize that in each of these analyses, the first two or three divisions consistently identified the cover types described earlier. Further note that these analyses were based on the current species composition of each plot under the current disturbance regime. Long-term changes in streamflow regime would most likely alter species composition of these plots. For further discussion and interpretation of TWINSPAN analysis and results, the reader is referred to Hill (1979).

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READING DATA MATRIX FROM DEVICE 5

  57  175VEGTEST2.OUT                                          TCMFFR** S

ONUMBER OF SAMPLES    175
ONUMBER OF SPECIES     57
OLENGTH OF RAW DATA ARRAY   3753
       6      1000        14      1000        15      1000        16      1000        54      1000        -1         6
    1000        15      1000        16      1000        24      1000        26      1000        56      1000        -1
       6      1000        16      1000        19      1000        26      1000        33      1000        37      1000
      -1         3      1000         6      1000        15      1000        16      1000        18      1000        19
    1000        26      1000        41      1000        -1         6      1000        15      1000        16      1000
      24      1000        26      1000        37      1000        -1        16      1000        26      1000        -1
       1      1000         6      1000        15      1000        16      1000        19      1000        52      1000
      55      1000        -1         1      1000         3      1000         5      1000         6      1000        15
    1000        16      1000        19      1000        37      1000        52      1000        55      1000        56
    1000        -1         1      1000         3      1000         6      1000        15      1000        16      1000
...........................................................................................................
      10      1000        15      1000        16      1000        17      1000        19      1000        26      1000
      35      1000        37      1000        38      1000        44      1000        45      1000        46      1000
      49      1000        52      1000        54      1000        57      1000        -1        48      1000        -1
      35      1000        -1        16      1000        45      1000        49      1000        -1        16      1000
      45      1000        49      1000        50      1000        -1        45      1000        49      1000        -1
      45      1000        -1         3      1000        -1         3      1000         4      1000        15      1000
      16      1000        17      1000        19      1000        23      1000        29      1000        38      1000
      41      1000        42      1000        45      1000        52      1000        55      1000        -1         3
    1000         4      1000         9      1000        15      1000        17      1000        28      1000        35
    1000        38      1000        42      1000        44      1000        52      1000        55      1000        -1

SPECIES NAMES
  1 ACGL      |  2 ACMI      |  3 ALTE      |  4 AMAL      |  5 ANAR      |  6 ASFO      |  7 ASMO      |  8 BERE
  9 BI        | 10 BRIN      | 11 CARE X1   | 12 CERE      | 13 CHLE      | 14 CISP P    | 15 COST      | 16 CW
 17 DF        | 18 EQAR      | 19 ES        | 20 FRVI      | 21 FUNK 4    | 22 FUNK 5    | 23 FUNK 6    | 24 GUNK 1
 25 GUNK 12   | 26 GUNK 3    | 27 GUNK 4    | 28 GUNK 5    | 29 GUNK 6    | 30 GUNK 7    | 31 GUNK 8    | 32 LA
 33 MEAL      | 34 MEOF      | 35 MESP P    | 36 OPHO      | 37 PHPR      | 38 POPA      | 39 PTAQ      | 40 RIIN
 41 ROWO      | 42 RUPA      | 43 RUST      | 44 SA        | 45 SALI X1   | 46 SALI X3   | 47 SALI X4   | 48 SALI X5
 49 SALI X6   | 50 SALI X7   | 51 SARA      | 52 SHCA      | 53 SMRA      | 54 SOCA      | 55 SYAL      | 56 TAOF
 57 WWP       |

SAMPLE NAMES
  1 PLOT105   |  2 PLOT106   |  3 PLOT107   |  4 PLOT108   |  5 PLOT109   |  6 PLOT110   |  7 PLOT111   |  8 PLOT112
  9 PLOT113   | 10 PLOT114   | 11 PLOT115   | 12 PLOT116   | 13 PLOT117   | 14 PLOT118   | 15 PLOT119   | 16 PLOT120
 17 PLOT121   | 18 PLOT122   | 19 PLOT123   | 20 PLOT124   | 21 PLOT125   | 22 PLOT201   | 23 PLOT202   | 24 PLOT203
 25 PLOT204   | 26 PLOT205   | 27 PLOT206   | 28 PLOT207   | 29 PLOT208   | 30 PLOT209   | 31 PLOT210   | 32 PLOT211
 33 PLOT212   | 34 PLOT213   | 35 PLOT214   | 36 PLOT215   | 37 PLOT216   | 38 PLOT217   | 39 PLOT218   | 40 PLOT219
 41 PLOT220   | 42 PLOT221   | 43 PLOT222   | 44 PLOT223   | 45 PLOT224   | 46 PLOT225   | 47 PLOT226   | 48 PLOT301
 49 PLOT302   | 50 PLOT303   | 51 PLOT304   | 52 PLOT305   | 53 PLOT306   | 54 PLOT307   | 55 PLOT308   | 56 PLOT309
 57 PLOT310   | 58 PLOT311   | 59 PLOT312   | 60 PLOT313   | 61 PLOT314   | 62 PLOT315   | 63 PLOT316   | 64 PLOT317
   65 PLOT318 |  66 PLOT319  |  67 PLOT320  |  68 PLOT401  |  69 PLOT402  |  70 PLOT403  |  71 PLOT404  |  72 PLOT405
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Figure 45. TWINSPAN output for presence absence of all species. Input data file is illustrated in Figure 44.

73 PLOT406	74 PLOT409	75 PLOT410	76 PLOT411	77 PLOT412	78 PLOT413	79 PLOT414	80 PLOT415
81 PLOT416	82 PLOT417	83 PLOT418	84 PLOT419	85 PLOT420	86 PLOT421	87 PLOT422	88 PLOT423
89 PLOT424	90 PLOT425	91 PLOT426	92 PLOT427	93 PLOT428	94 PLOT429	95 PLOT430	96 PLOT431
97 PLOT432	98 PLOT433	99 PLOT434	100 PLOT435	101 PLOT436	102 PLOT437	103 PLOT438	104 PLOT439
105 PLOT442	106 PLOT443	107 PLOT507	108 PLOT511	109 PLOT512	110 PLOT513	111 PLOT514	112 PLOT515
113 PLOT516	114 PLOT517	115 PLOT518	116 PLOT519	117 PLOT520	118 PLOT521	119 PLOT522	120 PLOT523
121 PLOT524	122 PLOT525	123 PLOT526	124 PLOT527	125 PLOT528	126 PLOT529	127 PLOT530	128 PLOT531
129 PLOT532	130 PLOT533	131 PLOT534	132 PLOT535	133 PLOT536	134 PLOT537	135 PLOT538	136 PLOT542
137 PLOT543	138 PLOT601	139 PLOT602	140 PLOT604	141 PLOT606	142 PLOT607	143 PLOT608	144 PLOT609
145 PLOT610	146 PLOT611	147 PLOT612	148 PLOT613	149 PLOT614	150 PLOT615	151 PLOT616	152 PLOT617
153 PLOT618	154 PLOT619	155 PLOT620	156 PLOT621	157 PLOT622	158 PLOT623	159 PLOT624	160 PLOT625
161 PLOT626	162 PLOT627	163 PLOT628	164 PLOT629	165 PLOT630	166 PLOT631	167 PLOT632	168 PLOT633
169 PLOT635	170 PLOT636	171 PLOT637	172 PLOT638	173 PLOT639	174 PLOT640	175 PLOT641	

```
DO YOU WISH TO OMIT SOME SAMPLES?
ENTER NUMBERS (NOT NAMES) OF ITEMS TO BE OMITTED
ONE PER LINE, ENDING LIST WITH A -1.
OTHER NEGATIVE NUMBERS DENOTE SEQUENCES.  FOR EXAMPLE
A 4 FOLLOWED BY A -8 OMITS ITEMS 4 THROUGH 8.
           -1

NOW ENTER INPUT PARAMETERS
DO YOU WANT ALL PARAMETERS SET TO THE DEFAULTS?   <Y,N>
ALL PARAMETERS ARE SET TO THE DEFAULTS:
  PSEUDOSPECIES CUT LEVELS ARE: 0 2 5 10 20
  MINIMUM GROUP SIZE FOR A DIVISION IS 5
  MAXIMUM NUMBER OF INDICATORS PER DIVISION IS 7
  MAXIMUM NUMBER OF SPECIES IN FINAL TABLE IS 100
  MAXIMUM LEVEL OF DIVISIONS IS 6
  NO DIAGRAMS OF DIVISIONS WILL BE PRINTED
  NO MACHINE READABLE OUTPUT WILL BE PRODUCED
  PSEUDOSPECIES WILL BE WEIGHTED EQUALLY
  ALL CUT LEVELS WILL HAVE EQUAL INDICATOR POTENTIAL
  ALL SPECIES WILL BE CONSIDERED POTENTIAL INDICATORS

LENGTH OF DATA ARRAY AFTER DEFINING PSEUDOSPECIES   1964

TOTAL NUMBER OF SPECIES AND PSEUDOSPECIES       57

NUMBER OF SPECIES, EXCLUDING PSEUDOSPECIES AND ONES WITH NO OCCURRENCES   57

****************************************************************************************************************
ODIVISION    1  (N= 175)          I.E. GROUP *
 EIGENVALUE  .374  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ES        1(-)   SALI X1  1(+)   SA        1(-)   SALI X6  1(+)   SALI X7  1(+)   SYAL      1(-)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
OITEMS IN NEGATIVE GROUP    2  (N=  140)          I.E. GROUP *0
 PLOT105   PLOT106   PLOT107   PLOT108   PLOT109   PLOT110   PLOT111   PLOT112   PLOT113   PLOT114   PLOT115   PLOT119
 PLOT120   PLOT121   PLOT122   PLOT123   PLOT124   PLOT125   PLOT201   PLOT202   PLOT203   PLOT204   PLOT205   PLOT206
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Figure 45. Continued.

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 PLOT207   PLOT208   PLOT209   PLOT210   PLOT211   PLOT212   PLOT213   PLOT214   PLOT215   PLOT216   PLOT217   PLOT218
 PLOT219   PLOT220   PLOT221   PLOT222   PLOT223   PLOT224   PLOT225   PLOT226   PLOT301   PLOT302   PLOT303   PLOT304
 PLOT305   PLOT306   PLOT307   PLOT308   PLOT309   PLOT310   PLOT311   PLOT312   PLOT313   PLOT314   PLOT315   PLOT316
 PLOT317   PLOT318   PLOT319   PLOT320   PLOT409   PLOT410   PLOT411   PLOT412   PLOT413   PLOT414   PLOT415   PLOT416
 PLOT417   PLOT418   PLOT419   PLOT420   PLOT421   PLOT422   PLOT423   PLOT424   PLOT425   PLOT426   PLOT427   PLOT428
 PLOT429   PLOT434   PLOT438   PLOT442   PLOT443   PLOT507   PLOT511   PLOT512   PLOT513   PLOT520   PLOT521   PLOT522
 PLOT524   PLOT525   PLOT526   PLOT528   PLOT529   PLOT531   PLOT532   PLOT533   PLOT534   PLOT535   PLOT536   PLOT537
 PLOT542   PLOT543   PLOT607   PLOT608   PLOT609   PLOT610   PLOT611   PLOT612   PLOT613   PLOT614   PLOT615   PLOT616
 PLOT617   PLOT618   PLOT619   PLOT620   PLOT621   PLOT622   PLOT623   PLOT624   PLOT625   PLOT626   PLOT627   PLOT628
 PLOT629   PLOT630   PLOT631   PLOT632   PLOT633   PLOT639   PLOT640   PLOT641

0BORDERLINE NEGATIVES     (N=      6)
 PLOT110   PLOT115   PLOT301   PLOT302   PLOT521   PLOT629
0MISCLASSIFIED NEGATIVES (N=      5)
 PLOT525   PLOT528   PLOT621   PLOT627   PLOT628
0ITEMS IN POSITIVE GROUP   3   (N=   35)          I.E. GROUP *1
 PLOT116   PLOT117   PLOT118   PLOT401   PLOT402   PLOT403   PLOT404   PLOT405   PLOT406   PLOT430   PLOT431   PLOT432
 PLOT433   PLOT435   PLOT436   PLOT437   PLOT439   PLOT514   PLOT515   PLOT516   PLOT517   PLOT518   PLOT519   PLOT523
 PLOT527   PLOT530   PLOT538   PLOT601   PLOT602   PLOT604   PLOT606   PLOT635   PLOT636   PLOT637   PLOT638
0BORDERLINE POSITIVES     (N=      6)
 PLOT430   PLOT433   PLOT437   PLOT519   PLOT523   PLOT530
0MISCLASSIFIED POSITIVES (N=      2)
 PLOT402   PLOT405
0NEGATIVE PREFERENTIALS
 ACGL      1( 61,  1) AMAL      1( 31,  0) ASFO      1( 66,  6) CISP P    1( 34,  3) COST      1( 89, 11) DF        1( 56,  2)
 ES        1(100,  3) GUNK 3    1( 36,  3) GUNK 6    1( 32,  3) MEAL      1( 39,  3) PHPR      1( 46,  0) ROWO      1( 43,  1)
 RUPA      1( 50,  2) SA        1( 82,  4) SHCA      1( 28,  1) SYAL      1( 65,  0) WWP       1( 29,  2)
0POSITIVE PREFERENTIALS
 SALI X1   1( 21, 27) SALI X3   1(  5, 16) SALI X6   1( 22, 25) SALI X7   1(  2, 16)
0NON-PREFERENTIALS
 ALTE      1( 41,  8) CW        1( 86, 27) EQAR      1( 55, 12) GUNK 8    1( 42,  7)
0   END OF LEVEL   1


*******************************************************************************************************************************
0DIVISION    2  (N= 140)         I.E. GROUP *0
 EIGENVALUE  .314  AT ITERATION   3
 INDICATORS, TOGETHER WITH THEIR SIGN
 CW        1(+)    RUPA      1(-)    MEAL      1(+)    SYAL      1(-)    GUNK 8    1(+)    ASFO      1(+)    EQAR      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
0ITEMS IN NEGATIVE GROUP   4   (N=   49)          I.E. GROUP *00
 PLOT119   PLOT120   PLOT121   PLOT122   PLOT123   PLOT124   PLOT125   PLOT220   PLOT221   PLOT222   PLOT223   PLOT224
 PLOT225   PLOT226   PLOT315   PLOT316   PLOT317   PLOT318   PLOT319   PLOT320   PLOT413   PLOT415   PLOT416   PLOT417
 PLOT422   PLOT424   PLOT425   PLOT426   PLOT427   PLOT428   PLOT429   PLOT442   PLOT443   PLOT507   PLOT511   PLOT512
 PLOT513   PLOT542   PLOT543   PLOT608   PLOT609   PLOT610   PLOT611   PLOT612   PLOT613   PLOT621   PLOT623   PLOT640
 PLOT641
0BORDERLINE NEGATIVES     (N=      4)
 PLOT415   PLOT608   PLOT621   PLOT640
0MISCLASSIFIED NEGATIVES (N=      6)
 PLOT413   PLOT426   PLOT507   PLOT542   PLOT609   PLOT611
0ITEMS IN POSITIVE GROUP   5   (N=   91)          I.E. GROUP *01
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Figure 45. Continued.

```
 PLOT105   PLOT106   PLOT107   PLOT108   PLOT109   PLOT110   PLOT111   PLOT112   PLOT113   PLOT114   PLOT115   PLOT201
 PLOT202   PLOT203   PLOT204   PLOT205   PLOT206   PLOT207   PLOT208   PLOT209   PLOT210   PLOT211   PLOT212   PLOT213
 PLOT214   PLOT215   PLOT216   PLOT217   PLOT218   PLOT219   PLOT301   PLOT302   PLOT303   PLOT304   PLOT305   PLOT306
 PLOT307   PLOT308   PLOT309   PLOT310   PLOT311   PLOT312   PLOT313   PLOT314   PLOT409   PLOT410   PLOT411   PLOT412
 PLOT414   PLOT418   PLOT419   PLOT420   PLOT421   PLOT423   PLOT434   PLOT438   PLOT520   PLOT521   PLOT522   PLOT524
 PLOT525   PLOT526   PLOT528   PLOT529   PLOT531   PLOT532   PLOT533   PLOT534   PLOT535   PLOT536   PLOT537   PLOT607
 PLOT614   PLOT615   PLOT616   PLOT617   PLOT618   PLOT619   PLOT620   PLOT622   PLOT624   PLOT625   PLOT626   PLOT627
 PLOT628   PLOT629   PLOT630   PLOT631   PLOT632   PLOT633   PLOT639
OBORDERLINE POSITIVES     (N=     12)
 PLOT219   PLOT304   PLOT409   PLOT410   PLOT414   PLOT420   PLOT421   PLOT423   PLOT524   PLOT534   PLOT616   PLOT619
OMISCLASSIFIED POSITIVES (N=       1)
 PLOT526
ONEGATIVE PREFERENTIALS
 AMAL      1( 18, 13) CARE X1  1( 11,  0) EQAR     1( 31, 24) GUNK 5   1( 13, 10) OPHO     1( 11,  0) ROWO     1( 23, 20)
 RUPA      1( 35, 15) RUST     1( 16,  8) SARA     1( 18,  5) SYAL     1( 37, 28)
OPOSITIVE PREFERENTIALS
 ASFO      1( 11, 55) CHLE     1(  2, 20) CW       1(  8, 78) GUNK 6   1(  5, 27) GUNK 8   1(  3, 39) LA       1(  4, 19)
 MEAL      1(  0, 39) PHPR     1(  5, 41) SALI X6  1(  1, 21) SOCA     1(  0, 22) TAOF     1(  0, 19) WWP      1(  1, 28)
ONON-PREFERENTIALS
 ACGL      1( 30, 31) ALTE     1( 10, 31) CISP P   1( 16, 18) COST     1( 42, 47) DF       1( 16, 40) ES       1( 32, 68)
 GUNK 3    1( 14, 22) SA       1( 33, 49) SHCA     1( 11, 17)
************************************************************************************************************************
ODIVISION    3  (N=  35)          I.E. GROUP *1
 EIGENVALUE  .321  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X7  1(+)    EQAR      1(-)    COST      1(-)    ALTE      1(-)    SALI X1  1(-)    ASFO      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP   6  (N=    23)          I.E. GROUP *10
 PLOT116   PLOT117   PLOT118   PLOT405   PLOT406   PLOT430   PLOT431   PLOT432   PLOT433   PLOT435   PLOT436   PLOT439
 PLOT516   PLOT517   PLOT518   PLOT523   PLOT527   PLOT530   PLOT538   PLOT604   PLOT635   PLOT637   PLOT638
OBORDERLINE NEGATIVES     (N=      2)
 PLOT436   PLOT635
OITEMS IN POSITIVE GROUP   7  (N=    12)          I.E. GROUP *11
 PLOT401   PLOT402   PLOT403   PLOT404   PLOT437   PLOT514   PLOT515   PLOT519   PLOT601   PLOT602   PLOT606   PLOT636
OBORDERLINE POSITIVES     (N=      1)
 PLOT606
ONEGATIVE PREFERENTIALS
 ALTE      1(  8,  0) ASFO     1(  6,  0) COST     1( 11,  0) EQAR     1( 11,  1) GUNK 8   1(  6,  1)
OPOSITIVE PREFERENTIALS
 SALI X7  1(  5, 11)
ONON-PREFERENTIALS
 CW        1( 17, 10) SALI X1  1( 21,  6) SALI X3  1( 12,  4) SALI X6  1( 17,  8)
0   END OF LEVEL   2


************************************************************************************************************************
ODIVISION    4  (N=  49)          I.E. GROUP *00
 EIGENVALUE  .247  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 EQAR      1(-)    DF        1(+)    ROWO      1(+)    OPHO      1(-)    SHCA      1(+)    ALTE      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
```

Figure 45. Continued.

```
OITEMS IN NEGATIVE GROUP   8  (N=   22)          I.E. GROUP *000
 PLOT124   PLOT125   PLOT220   PLOT221   PLOT222   PLOT223   PLOT224   PLOT225   PLOT226   PLOT315   PLOT316   PLOT317
 PLOT318   PLOT319   PLOT320   PLOT422   PLOT427   PLOT428   PLOT511   PLOT512   PLOT513   PLOT621
OBORDERLINE NEGATIVES    (N=    1)
 PLOT320
OMISCLASSIFIED NEGATIVES (N=    2)
 PLOT125   PLOT221
OITEMS IN POSITIVE GROUP   9  (N=   27)          I.E. GROUP *001
 PLOT119   PLOT120   PLOT121   PLOT122   PLOT123   PLOT413   PLOT415   PLOT416   PLOT417   PLOT424   PLOT425   PLOT426
 PLOT429   PLOT442   PLOT443   PLOT507   PLOT542   PLOT543   PLOT608   PLOT609   PLOT610   PLOT611   PLOT612   PLOT613
 PLOT623   PLOT640   PLOT641
OBORDERLINE POSITIVES    (N=    3)
 PLOT417   PLOT426   PLOT623
ONEGATIVE PREFERENTIALS
 CW       1(  5,  3) EQAR      1( 22,  9) FUNK 4    1(  5,  0) GUNK 12  1(  6,  1) OPHO      1( 11,  0) PTAQ      1(  6,  1)
 RUST     1( 10,  6) SARA      1( 12,  6) SMRA      1(  7,  2)
OPOSITIVE PREFERENTIALS
 ALTE     1(  0, 10) AMAL      1(  5, 13) ASFO      1(  1, 10) CISP P   1(  3, 13) DF        1(  1, 15) ROWO      1(  5, 18)
 SHCA     1(  0, 11)
ONON-PREFERENTIALS
 ACGL     1( 15, 15) CARE X1   1(  6,  5) COST      1( 17, 25) ES       1( 13, 19) GUNK 3    1(  5,  9) GUNK 5    1(  5,  8)
 RUPA     1( 19, 16) SA        1( 14, 19) SYAL      1( 14, 23)
********************************************************************************************************************************
ODIVISION    5  (N=  91)        I.E. GROUP *01
 EIGENVALUE  .226  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X6  1(+)    SOCA       1(+)    SALI X1  1(+)    EQAR      1(+)    ROWO       1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     2
OITEMS IN NEGATIVE GROUP  10  (N=   58)          I.E. GROUP *010
 PLOT106   PLOT107   PLOT109   PLOT110   PLOT111   PLOT112   PLOT113   PLOT114   PLOT115   PLOT201   PLOT202   PLOT203
 PLOT204   PLOT205   PLOT206   PLOT207   PLOT208   PLOT209   PLOT210   PLOT211   PLOT212   PLOT213   PLOT214   PLOT215
 PLOT216   PLOT217   PLOT218   PLOT219   PLOT301   PLOT303   PLOT304   PLOT305   PLOT306   PLOT307   PLOT308   PLOT309
 PLOT310   PLOT311   PLOT312   PLOT313   PLOT314   PLOT409   PLOT412   PLOT420   PLOT421   PLOT423   PLOT534   PLOT607
 PLOT614   PLOT615   PLOT616   PLOT618   PLOT619   PLOT620   PLOT622   PLOT632   PLOT633   PLOT639
OBORDERLINE NEGATIVES    (N=    6)
 PLOT219   PLOT301   PLOT303   PLOT423   PLOT614   PLOT615
OMISCLASSIFIED NEGATIVES (N=    1)
 PLOT304
OITEMS IN POSITIVE GROUP  11  (N=   33)          I.E. GROUP *011
 PLOT105   PLOT108   PLOT302   PLOT410   PLOT411   PLOT414   PLOT418   PLOT419   PLOT434   PLOT438   PLOT520   PLOT521
 PLOT522   PLOT524   PLOT525   PLOT526   PLOT528   PLOT529   PLOT531   PLOT532   PLOT533   PLOT535   PLOT536   PLOT537
 PLOT617   PLOT624   PLOT625   PLOT626   PLOT627   PLOT628   PLOT629   PLOT630   PLOT631
OMISCLASSIFIED POSITIVES (N=    6)
 PLOT105   PLOT410   PLOT411   PLOT414   PLOT419   PLOT617
ONEGATIVE PREFERENTIALS
 ACGL     1( 26,  5) CERE      1( 17,  1) CHLE      1( 18,  2) LA       1( 16,  3) TAOF      1( 17,  2)
OPOSITIVE PREFERENTIALS
 BI       1(  6,  7) BRIN      1(  0,  8) CISP P    1(  7, 11) EQAR     1(  7, 17) GUNK 4    1(  2,  8) GUNK 5    1(  3,  7)
 POPA     1(  3,  8) ROWO      1(  7, 13) SALI X1   1(  1, 16) SALI X6  1(  0, 21) SOCA      1(  3, 19)
ONON-PREFERENTIALS
```

Figure 45. Continued.

```
 ALTE      1( 18, 13) ASFO     1( 38, 17) COST     1( 25, 22) CW       1( 49, 29) DF       1( 25, 15) ES       1( 42, 26)
 GUNK 3    1( 16,  6) GUNK 6   1( 15, 12) GUNK 8   1( 22, 17) MEAL     1( 24, 15) PHPR     1( 24, 17) SA       1( 31, 18)
 SHCA      1( 13,  4) SYAL     1( 17, 11) WWP      1( 17, 11)
************************************************************************************************************************
0DIVISION    6  (N=  23)          I.E. GROUP *10
 EIGENVALUE  .289  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 CW         1(-)    SALI X6  1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
0ITEMS IN NEGATIVE GROUP  12  (N=   19)          I.E. GROUP *100
 PLOT405   PLOT406   PLOT430   PLOT431   PLOT432   PLOT433   PLOT435   PLOT436   PLOT439   PLOT516   PLOT517   PLOT518
 PLOT523   PLOT527   PLOT530   PLOT538   PLOT604   PLOT635   PLOT637
0ITEMS IN POSITIVE GROUP  13  (N=    4)          I.E. GROUP *101
 PLOT116   PLOT117   PLOT118   PLOT638
0NEGATIVE PREFERENTIALS
 ALTE      1(  8,  0) CW       1( 17,  0) EQAR     1( 10,  1) GUNK 8   1(  6,  0) SALI X6  1( 17,  0) SALI X7  1(  5,  0)
0POSITIVE PREFERENTIALS
 CHLE      1(  0,  1) CISP P   1(  2,  1) SALI X4  1(  1,  3)
0NON-PREFERENTIALS
 ASFO      1(  5,  1) COST     1(  8,  3) SALI X1  1( 17,  4) SALI X3  1(  9,  3)
************************************************************************************************************************
0DIVISION    7  (N=  12)          I.E. GROUP *11
 EIGENVALUE  .415  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 DF         1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
0ITEMS IN NEGATIVE GROUP  14  (N=    2)          I.E. GROUP *110
 PLOT437   PLOT519
0ITEMS IN POSITIVE GROUP  15  (N=   10)          I.E. GROUP *111
 PLOT401   PLOT402   PLOT403   PLOT404   PLOT514   PLOT515   PLOT601   PLOT602   PLOT606   PLOT636
0BORDERLINE POSITIVES      (N=    1)
 PLOT515
0NEGATIVE PREFERENTIALS
 ACGL      1(  1,  0) DF       1(  2,  0) ES       1(  2,  0) GUNK 3   1(  1,  0) GUNK 8   1(  1,  0) MEAL     1(  2,  0)
 RUPA      1(  1,  0) SA       1(  2,  0) SALI X1  1(  2,  4) SARA     1(  1,  0) SHCA     1(  1,  0) SOCA     1(  1,  1)
 TAOF      1(  1,  0) WWP      1(  1,  0)
0POSITIVE PREFERENTIALS
0NON-PREFERENTIALS
 CW         1(  2,  8) SALI X3  1(  1,  3) SALI X6  1(  2,  6) SALI X7  1(  2,  9)
0   END OF LEVEL   3

************************************************************************************************************************
0DIVISION    8  (N=  22)          I.E. GROUP *000
 EIGENVALUE  .303  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ACGL      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     0      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
0ITEMS IN NEGATIVE GROUP  16  (N=    7)          I.E. GROUP *0000
 PLOT422   PLOT427   PLOT428   PLOT511   PLOT512   PLOT513   PLOT621
0BORDERLINE NEGATIVES      (N=    1)
```

Figure 45. Continued.

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 PLOT422
OITEMS IN POSITIVE GROUP  17  (N=   15)          I.E. GROUP *0001
 PLOT124   PLOT125   PLOT220   PLOT221   PLOT222   PLOT223   PLOT224   PLOT225   PLOT226   PLOT315   PLOT316   PLOT317
 PLOT318   PLOT319   PLOT320
ONEGATIVE PREFERENTIALS
 CW        1(  3,  2) FUNK 6   1(  2,  0) SALI X5  1(  2,  1)
OPOSITIVE PREFERENTIALS
 ACGL      1(  0, 15) CARE X1  1(  0,  6) ES       1(  1, 12) FUNK 4   1(  0,  5) GUNK 1   1(  0,  3) GUNK 12  1(  0,  6)
 GUNK 5    1(  0,  5) GUNK 7   1(  0,  3) OPHO     1(  0, 11) PTAQ     1(  0,  6) RIIN     1(  0,  4) ROWO     1(  0,  5)
 SA        1(  0, 14) SARA     1(  1, 11) SMRA     1(  0,  7) SYAL     1(  1, 13)
ONON-PREFERENTIALS
 AMAL      1(  1,  4) COST     1(  4, 13) EQAR     1(  7, 15) GUNK 3   1(  2,  3) RUPA     1(  4, 15) RUST     1(  4,  6)
*************************************************************************************************************************
ODIVISION    9  (N=  27)          I.E. GROUP *001
 EIGENVALUE  .254  AT ITERATION   3
 INDICATORS, TOGETHER WITH THEIR SIGN
 DF        1(+)   SA        1(+)   CISP P   1(-)   RUST      1(-)   SHCA      1(+)   ACGL      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  18  (N=    6)          I.E. GROUP *0010
 PLOT424   PLOT425   PLOT426   PLOT442   PLOT507   PLOT623
OITEMS IN POSITIVE GROUP  19  (N=   21)          I.E. GROUP *0011
 PLOT119   PLOT120   PLOT121   PLOT122   PLOT123   PLOT413   PLOT415   PLOT416   PLOT417   PLOT429   PLOT443   PLOT542
 PLOT543   PLOT608   PLOT609   PLOT610   PLOT611   PLOT612   PLOT613   PLOT640   PLOT641
OBORDERLINE POSITIVES      (N=    2)
 PLOT443   PLOT608
ONEGATIVE PREFERENTIALS
 CISP P    1(  6,  7) GUNK 8   1(  2,  0) RUST     1(  4,  2)
OPOSITIVE PREFERENTIALS
00 ACGL      1(  1, 14) AMAL     1(  1, 12) ASFO     1(  0, 10) BERE     1(  0,  5) DF       1(  0, 15) GUNK 3   1(  1,  8)
 GUNK 5    1(  0,  8) RIIN     1(  0,  5) SA       1(  1, 18) SARA     1(  0,  6) SHCA     1(  0, 11)
ONON-PREFERENTIALS
 ALTE      1(  3,  7) COST     1(  5, 20) EQAR     1(  3,  6) ES       1(  3, 16) ROWO     1(  4, 14) RUPA     1(  5, 11)
 SYAL      1(  3, 20)
*************************************************************************************************************************
ODIVISION   10  (N=  58)          I.E. GROUP *010
 EIGENVALUE  .230  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X5  1(-)   CW        1(+)   ES        1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  20  (N=    1)          I.E. GROUP *0100
 PLOT632
OITEMS IN POSITIVE GROUP  21  (N=   57)          I.E. GROUP *0101
 PLOT106   PLOT107   PLOT109   PLOT110   PLOT111   PLOT112   PLOT113   PLOT114   PLOT115   PLOT201   PLOT202   PLOT203
 PLOT204   PLOT205   PLOT206   PLOT207   PLOT208   PLOT209   PLOT210   PLOT211   PLOT212   PLOT213   PLOT214   PLOT215
 PLOT216   PLOT217   PLOT218   PLOT219   PLOT301   PLOT303   PLOT304   PLOT305   PLOT306   PLOT307   PLOT308   PLOT309
 PLOT310   PLOT311   PLOT312   PLOT313   PLOT314   PLOT409   PLOT412   PLOT420   PLOT421   PLOT423   PLOT534   PLOT607
 PLOT614   PLOT615   PLOT616   PLOT618   PLOT619   PLOT620   PLOT622   PLOT633   PLOT639
ONEGATIVE PREFERENTIALS
 SALI X5  1(  1,  5)
OPOSITIVE PREFERENTIALS
 ACGL      1(  0, 26) ALTE     1(  0, 18) ASFO     1(  0, 38) CERE     1(  0, 17) CHLE     1(  0, 18) COST     1(  0, 25)
```

Figure 45. Continued.

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 CW       1(  0, 49) DF       1(  0, 25) ES       1(  0, 42) GUNK 3   1(  0, 16) GUNK 6   1(  0, 15) GUNK 8   1(  0, 22)
 LA       1(  0, 16) MEAL     1(  0, 24) PHPR     1(  0, 24) SA       1(  0, 31) SHCA     1(  0, 13) SYAL     1(  0, 17)
 TAOF     1(  0, 17) WWP      1(  0, 17)
ONON-PREFERENTIALS
************************************************************************************************************************
ODIVISION   11  (N=  33)          I.E. GROUP *011
 EIGENVALUE  .192  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X6  1(-)   ALTE      1(-)   CISP P   1(+)   GUNK 5   1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     0      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
OITEMS IN NEGATIVE GROUP  22  (N=   26)          I.E. GROUP *0110
 PLOT108  PLOT411  PLOT434   PLOT438   PLOT520   PLOT521   PLOT522   PLOT524   PLOT525   PLOT526   PLOT528   PLOT529
 PLOT531  PLOT532  PLOT533   PLOT535   PLOT536   PLOT537   PLOT617   PLOT625   PLOT626   PLOT627   PLOT628   PLOT629
 PLOT630  PLOT631
OBORDERLINE NEGATIVES     (N=      4)
 PLOT108  PLOT528  PLOT529   PLOT536
OITEMS IN POSITIVE GROUP  23  (N=    7)          I.E. GROUP *0111
 PLOT105  PLOT302  PLOT410   PLOT414   PLOT418   PLOT419   PLOT624
ONEGATIVE PREFERENTIALS
 ALTE     1( 13,  0) BI       1(  7,  0) BRIN     1(  8,  0) DF       1( 14,  1) GUNK 3   1(  6,  0) GUNK 6   1( 11,  1)
 POPA     1(  8,  0) SA       1( 16,  2) SALI X1  1( 15,  1) SALI X6  1( 20,  1) WWP      1( 11,  0)
OPOSITIVE PREFERENTIALS
 ACGL     1(  3,  2) ASMO     1(  3,  2) CHLE     1(  0,  2) CISP P   1(  6,  5) GUNK 5   1(  3,  4) MEOF     1(  1,  3)
ONON-PREFERENTIALS
 ASFO     1( 13,  4) COST     1( 17,  5) CW       1( 24,  5) EQAR     1( 14,  3) ES       1( 22,  4) GUNK 4   1(  6,  2)
 GUNK 8   1( 14,  3) MEAL     1( 13,  2) PHPR     1( 14,  3) ROWO     1(  9,  4) SOCA     1( 15,  4) SYAL     1(  8,  3)
************************************************************************************************************************
ODIVISION   12  (N=  19)          I.E. GROUP *100
 EIGENVALUE  .290  AT ITERATION   3
 INDICATORS, TOGETHER WITH THEIR SIGN
 EQAR     1(+)   CW        1(+)   SALI X3  1(+)   GUNK 8   1(+)    ASFO      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    2
OOITEMS IN NEGATIVE GROUP  24  (N=    5)          I.E. GROUP *1000
 PLOT439  PLOT523  PLOT530   PLOT635   PLOT637
OBORDERLINE NEGATIVES     (N=      1)
 PLOT439
OITEMS IN POSITIVE GROUP  25  (N=   14)          I.E. GROUP *1001
 PLOT405  PLOT406  PLOT430   PLOT431   PLOT432   PLOT433   PLOT435   PLOT436   PLOT516   PLOT517   PLOT518   PLOT527
 PLOT538  PLOT604
OBORDERLINE POSITIVES     (N=      1)
 PLOT431
ONEGATIVE PREFERENTIALS
 BI       1(  1,  1) ES       1(  1,  0) MEAL     1(  1,  0) ROWO     1(  1,  0) SA       1(  1,  1) SALI X5  1(  1,  0)
OPOSITIVE PREFERENTIALS
 ASFO     1(  0,  5) EQAR     1(  0, 10) GUNK 1   1(  0,  3) GUNK 4   1(  0,  3) GUNK 6   1(  0,  3) GUNK 8   1(  0,  6)
 SALI X3  1(  0,  9) SALI X7  1(  0,  5)
ONON-PREFERENTIALS
 ALTE     1(  2,  6) COST     1(  2,  6) CW       1(  3, 14) SALI X1  1(  4, 13) SALI X6  1(  5, 12)
************************************************************************************************************************
ODIVISION   13  (N=   4)          I.E. GROUP *101
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
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Figure 45. Continued.

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************************************************************************************************************************
ODIVISION   14  (N=   2)         I.E. GROUP *110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
************************************************************************************************************************
ODIVISION   15  (N=  10)         I.E. GROUP *111
 EIGENVALUE  .280  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X3  1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  30  (N=    3)         I.E. GROUP *1110
 PLOT515   PLOT601   PLOT602
OITEMS IN POSITIVE GROUP  31  (N=    7)         I.E. GROUP *1111
 PLOT401   PLOT402   PLOT403   PLOT404   PLOT514   PLOT606   PLOT636
OBORDERLINE POSITIVES     (N=    2)
 PLOT403   PLOT636
ONEGATIVE PREFERENTIALS
 SALI X1  1(  2,  2) SALI X3  1(  3,  0) SOCA     1(  1,  0)
OPOSITIVE PREFERENTIALS
ONON-PREFERENTIALS
 CW       1(  2,  6) SALI X6  1(  2,  4) SALI X7  1(  3,  6)
0   END OF LEVEL   4

************************************************************************************************************************
ODIVISION   16  (N=   7)         I.E. GROUP *0000
 EIGENVALUE  .421  AT ITERATION   3
 INDICATORS, TOGETHER WITH THEIR SIGN
 GUNK 3   1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
OITEMS IN NEGATIVE GROUP  32  (N=    5)         I.E. GROUP *00000
 PLOT427   PLOT428   PLOT511   PLOT512   PLOT513
OITEMS IN POSITIVE GROUP  33  (N=    2)         I.E. GROUP *00001
 PLOT422   PLOT621
ONEGATIVE PREFERENTIALS
 AMAL     1(  1,  0) LA       1(  1,  0) MESP P   1(  1,  0) POPA     1(  1,  0)
OPOSITIVE PREFERENTIALS
0 CISP P   1(  0,  1) COST     1(  2,  2) ES       1(  0,  1) FRVI     1(  0,  1) FUNK 5   1(  0,  1) FUNK 6   1(  1,  1)
 GUNK 3   1(  0,  2) PHPR     1(  0,  1) RUPA     1(  2,  2) RUST     1(  2,  2) SALI X1  1(  0,  1) SALI X5  1(  0,  2)
 SARA     1(  0,  1) SYAL     1(  0,  1)
ONON-PREFERENTIALS
 CW       1(  2,  1) EQAR     1(  5,  2)
************************************************************************************************************************
ODIVISION   17  (N=  15)         I.E. GROUP *0001
 EIGENVALUE  .222  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 CARE X1  1(-)    GUNK 12  1(-)    AMAL      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  34  (N=    7)         I.E. GROUP *00010
 PLOT223   PLOT224   PLOT225   PLOT226   PLOT318   PLOT319   PLOT320
OITEMS IN POSITIVE GROUP  35  (N=    8)         I.E. GROUP *00011
 PLOT124   PLOT125   PLOT220   PLOT221   PLOT222   PLOT315   PLOT316   PLOT317
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Figure 45. Continued.

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ONEGATIVE PREFERENTIALS
 CARE X1  1(  6,  0) GUNK 1   1(  3,  0) GUNK 12  1(  5,  1) GUNK 3   1(  3,  0) GUNK 5   1(  4,  1) GUNK 7   1(  3,  0)
 OPHO     1(  7,  4) PHPR     1(  2,  0) POPA     1(  2,  0) PTAQ     1(  4,  2) RUST     1(  4,  2)
OPOSITIVE PREFERENTIALS
 AMAL     1(  0,  4) CW       1(  0,  2) FUNK 4   1(  1,  4)
ONON-PREFERENTIALS
 ACGL     1(  7,  8) COST     1(  6,  7) EQAR     1(  7,  8) ES       1(  6,  6) RIIN     1(  2,  2) ROWO     1(  3,  2)
 RUPA     1(  7,  8) SA       1(  7,  7) SARA     1(  4,  7) SMRA     1(  3,  4) SYAL     1(  5,  8)
*****************************************************************************************************************************
ODIVISION   18  (N=    6)        I.E. GROUP *0010
 EIGENVALUE  .417  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
 ALTE      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP      0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     1
OITEMS IN NEGATIVE GROUP  36  (N=     3)          I.E. GROUP *00100
 PLOT426   PLOT507   PLOT623
OITEMS IN POSITIVE GROUP  37  (N=     3)          I.E. GROUP *00101
 PLOT424   PLOT425   PLOT442
ONEGATIVE PREFERENTIALS
 ANAR     1(  1,  0) CARE X1  1(  1,  0) FUNK 6   1(  1,  0) GUNK 8   1(  2,  0) MEOF     1(  1,  0) SA       1(  1,  0)
OPOSITIVE PREFERENTIALS
 ACGL     1(  0,  1) ALTE     1(  0,  3) AMAL     1(  0,  1) BI       1(  0,  1) CHLE     1(  0,  1) EQAR     1(  0,  3)
 ES       1(  1,  2) GUNK 3   1(  0,  1) ROWO     1(  1,  3) SALI X6  1(  0,  1) SMRA     1(  0,  1) SYAL     1(  1,  2)
ONON-PREFERENTIALS
 CISP P   1(  3,  3) COST     1(  2,  3) RUPA     1(  2,  3) RUST     1(  2,  2)
*****************************************************************************************************************************
ODIVISION   19  (N=  21)         I.E. GROUP *0011
 EIGENVALUE  .219  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SHCA      1(-)   GUNK 5    1(-)   SARA      1(+)   ALTE      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     0
OITEMS IN NEGATIVE GROUP  38  (N=    13)          I.E. GROUP *00110
 PLOT413   PLOT416   PLOT417   PLOT429   PLOT443   PLOT542   PLOT543   PLOT609   PLOT611   PLOT612   PLOT613   PLOT640
 PLOT641
OBORDERLINE NEGATIVES      (N=       1)
 PLOT413
OITEMS IN POSITIVE GROUP  39  (N=     8)          I.E. GROUP *00111
 PLOT119   PLOT120   PLOT121   PLOT122   PLOT123   PLOT415   PLOT608   PLOT610
ONEGATIVE PREFERENTIALS
 ALTE     1(  7,  0) ASFO     1(  8,  2) BI       1(  3,  0) CARE X1  1(  4,  0) CW       1(  3,  0) EQAR     1(  6,  0)
 GUNK 5   1(  8,  0) RIIN     1(  5,  0) SHCA     1( 10,  1)
OPOSITIVE PREFERENTIALS
 BERE     1(  2,  3) FRVI     1(  1,  2) GUNK 7   1(  0,  3) LA       1(  1,  2) SALI X4  1(  1,  2) SARA     1(  1,  5)
ONON-PREFERENTIALS
 ACGL     1(  8,  6) AMAL     1(  7,  5) ANAR     1(  3,  1) CISP P   1(  4,  3) COST     1( 13,  7) DF       1( 10,  5)
 ES       1( 11,  5) GUNK 3   1(  6,  2) GUNK 4   1(  2,  2) GUNK 6   1(  3,  1) POPA     1(  3,  1) ROWO     1( 10,  4)
 RUPA     1(  6,  5) SA       1( 11,  7) SYAL     1( 12,  8)
*****************************************************************************************************************************
ODIVISION   20  (N=    1)        I.E. GROUP *0100
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*****************************************************************************************************************************
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Figure 45. Continued.

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ODIVISION   21  (N=  57)          I.E. GROUP *0101
 EIGENVALUE  .222  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 COST      1(+)   DF          1(-)   MEAL      1(-)   ES          1(-)   LA          1(-)   AMAL      1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  42  (N=   32)          I.E. GROUP *01010
 PLOT107   PLOT113   PLOT114   PLOT115   PLOT201   PLOT202   PLOT203   PLOT204   PLOT205   PLOT206   PLOT207   PLOT208
 PLOT209   PLOT210   PLOT211   PLOT212   PLOT213   PLOT215   PLOT216   PLOT217   PLOT218   PLOT301   PLOT308   PLOT309
 PLOT310   PLOT311   PLOT312   PLOT313   PLOT614   PLOT616   PLOT618   PLOT633
OBORDERLINE NEGATIVES     (N=    3)
 PLOT614   PLOT616   PLOT618
OMISCLASSIFIED NEGATIVES (N=     3)
 PLOT301   PLOT308   PLOT633
OITEMS IN POSITIVE GROUP  43  (N=   25)          I.E. GROUP *01011
 PLOT106   PLOT109   PLOT110   PLOT111   PLOT112   PLOT214   PLOT219   PLOT303   PLOT304   PLOT305   PLOT306   PLOT307
 PLOT314   PLOT409   PLOT412   PLOT420   PLOT421   PLOT423   PLOT534   PLOT607   PLOT615   PLOT619   PLOT620   PLOT622
 PLOT639
OBORDERLINE POSITIVES     (N=    5)
 PLOT111   PLOT112   PLOT214   PLOT615   PLOT622
OMISCLASSIFIED POSITIVES (N=     2)
 PLOT306   PLOT619
ONEGATIVE PREFERENTIALS
 CERE      1( 14,  3) CHLE     1( 14,  4) DF       1( 21,  4) GUNK 6   1( 12,  3) LA       1( 15,  1) MEAL     1( 19,  5)
OPOSITIVE PREFERENTIALS
 AMAL      1(  2,  9) CISP P   1(  1,  6) COST     1(  7, 18) GUNK 3   1(  5, 11) MEOF     1(  2,  5) ROWO     1(  1,  6)
 RUPA      1(  2,  7) RUST     1(  1,  7) SYAL     1(  5, 12)
ONON-PREFERENTIALS
 ACGL      1( 14, 12) ALTE     1( 10,  8) ASFO     1( 25, 13) CW       1( 29, 20) ES       1( 30, 12) GUNK 8   1( 13,  9)
 MESP P    1(  7,  4) PHPR     1( 12, 12) SA       1( 20, 11) SHCA     1(  9,  4) TAOF     1( 11,  6) WWP      1( 10,  7)
*****************************************************************************************************************************
ODIVISION   22  (N=  26)          I.E. GROUP *0110
 EIGENVALUE  .185  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 GUNK 8    1(-)   MEAL      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1      MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  44  (N=   17)          I.E. GROUP *01100
 PLOT411   PLOT434   PLOT438   PLOT520   PLOT525   PLOT528   PLOT529   PLOT531   PLOT532   PLOT533   PLOT536   PLOT537
 PLOT617   PLOT625   PLOT626   PLOT627   PLOT628
OITEMS IN POSITIVE GROUP  45  (N=    9)          I.E. GROUP *01101
 PLOT108   PLOT521   PLOT522   PLOT524   PLOT526   PLOT535   PLOT629   PLOT630   PLOT631
OBORDERLINE POSITIVES     (N=    2)
 PLOT526   PLOT629
ONEGATIVE PREFERENTIALS
 GUNK 8    1( 14,  0) MEAL     1( 13,  0) PHPR     1( 12,  2) POPA     1(  7,  1) RUPA     1(  5,  0) WWP      1(  9,  2)
OPOSITIVE PREFERENTIALS
 GUNK 3    1(  1,  5) MESP P   1(  0,  4) ROWO     1(  4,  5) SALI X3  1(  1,  3)
ONON-PREFERENTIALS
 ALTE      1(  8,  5) ASFO     1(  8,  5) BI       1(  4,  3) BRIN     1(  5,  3) CISP P   1(  4,  2) COST     1( 11,  6)
 CW        1( 15,  9) DF       1( 11,  3) EQAR     1(  9,  5) ES       1( 13,  9) GUNK 4   1(  3,  3) GUNK 6   1(  8,  3)
 SA        1( 10,  6) SALI X1  1(  9,  6) SALI X6  1( 13,  7) SOCA     1( 10,  5) SYAL     1(  6,  2)
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Figure 45. Continued.

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0DIVISION   23  (N=   7)          I.E. GROUP *0111
 EIGENVALUE  .436  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ES       1(-)   ACGL      1(-)   CHLE      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -2     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP   -1
0ITEMS IN NEGATIVE GROUP  46  (N=    3)          I.E. GROUP *01110
 PLOT414   PLOT418   PLOT419
0ITEMS IN POSITIVE GROUP  47  (N=    4)          I.E. GROUP *01111
 PLOT105   PLOT302   PLOT410   PLOT624
0NEGATIVE PREFERENTIALS
 ACGL     1(  2,  0) CHLE     1(  2,  0) COST     1(  3,  2) DF       1(  1,  0) EQAR     1(  2,  1) ES       1(  3,  1)
 GUNK 4   1(  2,  0) GUNK 6   1(  1,  0) GUNK 8   1(  2,  1) LA       1(  1,  0) MEAL     1(  2,  0) PHPR     1(  2,  1)
 RUPA     1(  1,  0) SALI X5  1(  1,  0)
0POSITIVE PREFERENTIALS
 ASFO     1(  1,  3) ASMO     1(  0,  2) CW       1(  1,  4) FRVI     1(  0,  1) GUNK 7   1(  0,  1) ROWO     1(  1,  3)
 SALI X1  1(  0,  1) SALI X4  1(  0,  1) SALI X6  1(  0,  1) SHCA     1(  0,  1)
0NON-PREFERENTIALS
 CISP P   1(  2,  3) GUNK 5   1(  2,  2) MEOF     1(  1,  2) SA       1(  1,  1) SOCA     1(  2,  2) SYAL     1(  1,  2)
************************************************************************************************************************
0DIVISION   24  (N=   5)          I.E. GROUP *1000
 EIGENVALUE  .556  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
 MEAL     1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
0ITEMS IN NEGATIVE GROUP  48  (N=    1)          I.E. GROUP *10000
 PLOT530
0ITEMS IN POSITIVE GROUP  49  (N=    4)          I.E. GROUP *10001
 PLOT439   PLOT523   PLOT635   PLOT637
0NEGATIVE PREFERENTIALS
 COST     1(  1,  1) CW       1(  1,  2) MEAL     1(  1,  0) ROWO     1(  1,  0) SALI X5  1(  1,  0)
0POSITIVE PREFERENTIALS
 ALTE     1(  0,  2) BI       1(  0,  1) ES       1(  0,  1) SA       1(  0,  1) SALI X1  1(  0,  4)
0NON-PREFERENTIALS
 SALI X6  1(  1,  4)
************************************************************************************************************************
0DIVISION   25  (N=  14)          I.E. GROUP *1001
 EIGENVALUE  .306  AT ITERATION   3
 INDICATORS, TOGETHER WITH THEIR SIGN
 GUNK 6   1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
0ITEMS IN NEGATIVE GROUP  50  (N=   11)          I.E. GROUP *10010
 PLOT405   PLOT406   PLOT431   PLOT432   PLOT435   PLOT436   PLOT516   PLOT518   PLOT527   PLOT538   PLOT604
0BORDERLINE NEGATIVES     (N=    1)
 PLOT604
0ITEMS IN POSITIVE GROUP  51  (N=    3)          I.E. GROUP *10011
 PLOT430   PLOT433   PLOT517
0NEGATIVE PREFERENTIALS
 EQAR     1( 10,  0) GUNK 4   1(  3,  0)
0POSITIVE PREFERENTIALS
 ASFO     1(  2,  3) ASMO     1(  1,  1) BI       1(  0,  1) CARE X1  1(  0,  1) GUNK 1   1(  1,  2) GUNK 3   1(  1,  1)
 GUNK 6   1(  0,  3) SA       1(  0,  1)
```

Figure 45. Continued.

```
ONON-PREFERENTIALS
 ALTE     1(  5,  1) COST     1(  4,  2) CW        1( 11,  3) GUNK 8   1(  4,  2) SALI X1  1( 10,  3) SALI X3  1(  7,  2)
 SALI X6  1(  9,  3) SALI X7  1(  4,  1)
 ****************************************************************************************************************************
ODIVISION   30  (N=   3)         I.E. GROUP *1110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ****************************************************************************************************************************
ODIVISION   31  (N=   7)         I.E. GROUP *1111
 EIGENVALUE  .217  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 SALI X6  1(-)   SALI X1  1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -2     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP   -1
OITEMS IN NEGATIVE GROUP  62  (N=    2)         I.E. GROUP *11110
 PLOT403   PLOT636
OITEMS IN POSITIVE GROUP  63  (N=    5)         I.E. GROUP *11111
 PLOT401   PLOT402   PLOT404   PLOT514   PLOT606
OBORDERLINE POSITIVES     (N=    1)
 PLOT404
ONEGATIVE PREFERENTIALS
 SALI X1  1(  2,  0) SALI X6  1(  2,  2)
OPOSITIVE PREFERENTIALS
 EQAR     1(  0,  1)
ONON-PREFERENTIALS
 CW       1(  2,  4) SALI X7  1(  2,  4)
0   END OF LEVEL   5


 ****************************************************************************************************************************
ODIVISION   32  (N=   5)         I.E. GROUP *00000
 EIGENVALUE  .521  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
 COST     1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
OITEMS IN NEGATIVE GROUP  64  (N=    3)         I.E. GROUP *000000
 PLOT511   PLOT512   PLOT513
OITEMS IN POSITIVE GROUP  65  (N=    2)         I.E. GROUP *000001
 PLOT427   PLOT428
ONEGATIVE PREFERENTIALS
OPOSITIVE PREFERENTIALS
 AMAL     1(  0,  1) COST     1(  0,  2) CW       1(  0,  2) FUNK 6   1(  0,  1) LA       1(  0,  1) MESP P   1(  0,  1)
 POPA     1(  0,  1) RUPA     1(  0,  2) RUST     1(  0,  2)
ONON-PREFERENTIALS
 EQAR     1(  3,  2)
 ****************************************************************************************************************************
ODIVISION   33  (N=   2)         I.E. GROUP *00001
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ****************************************************************************************************************************
ODIVISION   34  (N=   7)         I.E. GROUP *00010
 EIGENVALUE  .236  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ASFO     1(-)
```

Figure 45. Continued.

```
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  68  (N=    1)          I.E. GROUP *000100
 PLOT225
OITEMS IN POSITIVE GROUP  69  (N=    6)          I.E. GROUP *000101
 PLOT223   PLOT224   PLOT226   PLOT318   PLOT319   PLOT320
ONEGATIVE PREFERENTIALS
 ASFO     1(  1,  0) CISP P   1(  1,  0) FUNK 4   1(  1,  0) GUNK 5   1(  1,  3) GUNK 8   1(  1,  0) PHPR     1(  1,  1)
 PTAQ     1(  1,  3) RUST     1(  1,  3) SMRA     1(  1,  2)
OPOSITIVE PREFERENTIALS
 GUNK 1   1(  0,  3) GUNK 12  1(  0,  5) GUNK 3   1(  0,  3) GUNK 7   1(  0,  3) POPA     1(  0,  2) RIIN     1(  0,  2)
 ROWO     1(  0,  3) SARA     1(  0,  4)
ONON-PREFERENTIALS
 ACGL     1(  1,  6) CARE X1  1(  1,  5) COST     1(  1,  5) EQAR     1(  1,  6) ES       1(  1,  5) OPHO     1(  1,  6)
 RUPA     1(  1,  6) SA       1(  1,  6) SYAL     1(  1,  4)
******************************************************************************************************************************
ODIVISION   35  (N=    8)        I.E. GROUP *00011
 EIGENVALUE  .249  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
 AMAL     1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  70  (N=    4)          I.E. GROUP *000110
 PLOT221   PLOT222   PLOT315   PLOT316
OITEMS IN POSITIVE GROUP  71  (N=    4)          I.E. GROUP *000111
 PLOT124   PLOT125   PLOT220   PLOT317
ONEGATIVE PREFERENTIALS
 AMAL     1(  4,  0) BI       1(  1,  0) CW       1(  2,  0) ES       1(  4,  2) FUNK 4   1(  3,  1) GUNK 12  1(  1,  0)
 GUNK 5   1(  1,  0) RIIN     1(  2,  0) RUST     1(  2,  0) SALI X5  1(  1,  0)
OPOSITIVE PREFERENTIALS
 CISP P   1(  0,  1) DF       1(  0,  1) FRVI     1(  0,  1) GUNK 6   1(  0,  1) PTAQ     1(  0,  2) SALI X1  1(  0,  1)
ONON-PREFERENTIALS
 ACGL     1(  4,  4) COST     1(  4,  3) EQAR     1(  4,  4) OPHO     1(  2,  2) ROWO     1(  1,  1) RUPA     1(  4,  4)
 SA       1(  3,  4) SARA     1(  4,  3) SMRA     1(  2,  2) SYAL     1(  4,  4)
******************************************************************************************************************************
ODIVISION   36  (N=    3)        I.E. GROUP *00100
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
******************************************************************************************************************************
ODIVISION   37  (N=    3)        I.E. GROUP *00101
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
******************************************************************************************************************************
ODIVISION   38  (N=  13)         I.E. GROUP *00110
 EIGENVALUE  .221  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ASFO     1(+)   BI       1(-)   CW       1(-)   AMAL     1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  76  (N=    5)          I.E. GROUP *001100
 PLOT429   PLOT543   PLOT609   PLOT640   PLOT641
OITEMS IN POSITIVE GROUP  77  (N=    8)          I.E. GROUP *001101
 PLOT413   PLOT416   PLOT417   PLOT443   PLOT542   PLOT611   PLOT612   PLOT613
ONEGATIVE PREFERENTIALS
 ALTE     1(  4,  3) AMAL     1(  4,  3) BERE     1(  2,  0) BI       1(  3,  0) CW       1(  3,  0) FRVI     1(  1,  0)
 FUNK 6   1(  1,  0) GUNK 1   1(  1,  0) MESP P   1(  1,  0) POPA     1(  2,  1) RUST     1(  2,  0) SALI X1  1(  1,  0)
```

Figure 45. Continued.

```
OPOSITIVE PREFERENTIALS
 ANAR     1(  0,  3) ASFO     1(  1,  7) EQAR     1(  1,  5) GUNK 3   1(  1,  5) RIIN     1(  1,  4)
ONON-PREFERENTIALS
 ACGL     1(  2,  6) CARE X1  1(  1,  3) CISP P   1(  1,  3) COST     1(  5,  8) DF       1(  5,  5) ES       1(  3,  8)
 GUNK 4   1(  1,  1) GUNK 5   1(  4,  4) GUNK 6   1(  1,  2) ROWO     1(  3,  7) RUPA     1(  2,  4) SA       1(  4,  7)
 SHCA     1(  5,  5) SYAL     1(  5,  7)
*****************************************************************************************************************************
ODIVISION   39  (N=   8)         I.E. GROUP *00111
 EIGENVALUE  .340  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 RUPA     1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
OITEMS IN NEGATIVE GROUP  78  (N=    5)         I.E. GROUP *001110
 PLOT119   PLOT120   PLOT121   PLOT122   PLOT123
OITEMS IN POSITIVE GROUP  79  (N=    3)         I.E. GROUP *001111
 PLOT415   PLOT608   PLOT610
ONEGATIVE PREFERENTIALS
 AMAL     1(  4,  1) ANAR     1(  1,  0) ASFO     1(  2,  0) CISP P   1(  3,  0) FRVI     1(  2,  0) GUNK 1   1(  1,  0)
 GUNK 3   1(  2,  0) GUNK 6   1(  1,  0) GUNK 7   1(  3,  0) PHPR     1(  1,  0) POPA     1(  1,  0) RUPA     1(  5,  0)
 SALI X1  1(  1,  0) SALI X3  1(  1,  0) SALI X4  1(  2,  0) SARA     1(  5,  0) SHCA     1(  1,  0) WWP      1(  1,  0)
OPOSITIVE PREFERENTIALS
 MEOF     1(  0,  1)
ONON-PREFERENTIALS
 ACGL     1(  4,  2) BERE     1(  2,  1) COST     1(  4,  3) DF       1(  3,  2) ES       1(  3,  2) GUNK 4   1(  1,  1)
 LA       1(  1,  1) ROWO     1(  2,  2) SA       1(  4,  3) SYAL     1(  5,  3)
*****************************************************************************************************************************
ODIVISION   42  (N=  32)         I.E. GROUP *01010
 EIGENVALUE  .258  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 ES       1(+)    CW       1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
OITEMS IN NEGATIVE GROUP  84  (N=    1)         I.E. GROUP *010100
 PLOT633
OITEMS IN POSITIVE GROUP  85  (N=   31)         I.E. GROUP *010101
 PLOT107   PLOT113   PLOT114   PLOT115   PLOT201   PLOT202   PLOT203   PLOT204   PLOT205   PLOT206   PLOT207   PLOT208
 PLOT209   PLOT210   PLOT211   PLOT212   PLOT213   PLOT215   PLOT216   PLOT217   PLOT218   PLOT301   PLOT308   PLOT309
 PLOT310   PLOT311   PLOT312   PLOT313   PLOT614   PLOT616   PLOT618
OBORDERLINE POSITIVES     (N=    1)
 PLOT202
ONEGATIVE PREFERENTIALS
 MESP P   1(  1,  6)
OPOSITIVE PREFERENTIALS
 ACGL     1(  0, 14) ALTE     1(  0, 10) ASFO     1(  0, 25) CERE     1(  0, 14) CHLE     1(  0, 14) COST     1(  0,  7)
 CW       1(  0, 29) DF       1(  0, 21) ES       1(  0, 30) GUNK 6   1(  0, 12) GUNK 8   1(  0, 13) LA       1(  0, 15)
 MEAL     1(  0, 19) PHPR     1(  0, 12) SA       1(  0, 20) SHCA     1(  0,  9) TAOF     1(  0, 11) WWP      1(  0, 10)
ONON-PREFERENTIALS
*****************************************************************************************************************************
ODIVISION   43  (N=  25)         I.E. GROUP *01011
 EIGENVALUE  .322  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 GUNK 8   1(+)    RUST     1(+)    MEAL     1(+)    MEOF     1(+)    CISP P   1(+)    CHLE     1(+)
```

Figure 45. Continued.

```
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     2
OITEMS IN NEGATIVE GROUP  86  (N=   15)         I.E. GROUP *010110
 PLOT106   PLOT109   PLOT110   PLOT111   PLOT112   PLOT214   PLOT303   PLOT304   PLOT305   PLOT306   PLOT307   PLOT421
 PLOT423   PLOT534   PLOT639
OITEMS IN POSITIVE GROUP  87  (N=   10)         I.E. GROUP *010111
 PLOT219   PLOT314   PLOT409   PLOT412   PLOT420   PLOT607   PLOT615   PLOT619   PLOT620   PLOT622
ONEGATIVE PREFERENTIALS
 ALTE      1(  6,  2) ASFO     1( 10,  3) BI       1(  3,  0) DF       1(  4,  0) ES       1(  9,  3) MESP P   1(  3,  1)
 SHCA      1(  3,  1) TAOF     1(  6,  0) WWP      1(  6,  1)
OPOSITIVE PREFERENTIALS
 ACMI      1(  0,  2) ASMO     1(  0,  2) CHLE     1(  0,  4) CISP P   1(  1,  5) GUNK 6   1(  0,  3) GUNK 8   1(  1,  8)
 MEAL      1(  0,  5) MEOF     1(  0,  5) PHPR     1(  5,  7) RUPA     1(  3,  4) RUST     1(  1,  6) SALI X5  1(  1,  2)
 SARA      1(  1,  3) SYAL     1(  5,  7)
ONON-PREFERENTIALS
 ACGL      1(  8,  4) AMAL     1(  5,  4) COST     1( 13,  5) CW       1( 13,  7) EQAR     1(  2,  2) GUNK 1   1(  2,  2)
 GUNK 3    1(  8,  3) ROWO     1(  4,  2) SA       1(  7,  4)
**********************************************************************************************************************
ODIVISION   44  (N=  17)        I.E. GROUP *01100
 EIGENVALUE  .236  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 BRIN      1(+)    ALTE      1(-)    BI        1(-)    CISP P   1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -2     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    -1
OITEMS IN NEGATIVE GROUP  88  (N=    6)         I.E. GROUP *011000
 PLOT525   PLOT531   PLOT532   PLOT536   PLOT537   PLOT617
OMISCLASSIFIED NEGATIVES (N=     1)
 PLOT525
OITEMS IN POSITIVE GROUP  89  (N=   11)         I.E. GROUP *011001
 PLOT411   PLOT434   PLOT438   PLOT520   PLOT528   PLOT529   PLOT533   PLOT625   PLOT626   PLOT627   PLOT628
OBORDERLINE POSITIVES     (N=     2)
 PLOT520   PLOT529
ONEGATIVE PREFERENTIALS
 ALTE      1(  5,  3) AMAL     1(  2,  0) ASMO     1(  3,  0) BI       1(  4,  0) CISP P   1(  4,  0) GUNK 4   1(  2,  1)
 POPA      1(  4,  3) SALI X7  1(  2,  0) WWP      1(  5,  4)
OPOSITIVE PREFERENTIALS
 ACGL      1(  0,  3) BRIN     1(  0,  5) GUNK 5   1(  0,  3) SOCA     1(  2,  8)
ONON-PREFERENTIALS
 ASFO      1(  2,  6) COST     1(  5,  6) CW       1(  5, 10) DF       1(  4,  7) EQAR     1(  4,  5) ES       1(  6,  7)
 GUNK 6    1(  3,  5) GUNK 8   1(  6,  8) MEAL     1(  4,  9) PHPR     1(  3,  9) ROWO     1(  1,  3) RUPA     1(  2,  3)
 SA        1(  4,  6) SALI X1  1(  2,  7) SALI X6  1(  6,  7) SYAL     1(  3,  3)
**********************************************************************************************************************
ODIVISION   45  (N=   9)        I.E. GROUP *01101
 EIGENVALUE  .272  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 GUNK 4    1(+)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP     0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     1
OITEMS IN NEGATIVE GROUP  90  (N=    6)         I.E. GROUP *011010
 PLOT108   PLOT521   PLOT522   PLOT524   PLOT630   PLOT631
OBORDERLINE NEGATIVES     (N=     1)
 PLOT630
OITEMS IN POSITIVE GROUP  91  (N=    3)         I.E. GROUP *011011
 PLOT526   PLOT535   PLOT629
```

Figure 45. Continued.

```
ONEGATIVE PREFERENTIALS
 ALTE     1(  4,  1) COST      1(  5,  1) EQAR      1(  4,  1) GUNK 3    1(  5,  0) PHPR      1(  2,  0) ROWO      1(  4,  1)
 SALI X3  1(  3,  0) WWP       1(  2,  0)
OPOSITIVE PREFERENTIALS
 CISP P   1(  1,  1) DF        1(  1,  2) GUNK 4    1(  0,  3) GUNK 6    1(  1,  2) SOCA      1(  2,  3) SYAL      1(  0,  2)
 TAOF     1(  0,  1)
ONON-PREFERENTIALS
 ASFO     1(  3,  2) BI        1(  2,  1) BRIN      1(  2,  1) CW        1(  6,  3) ES        1(  6,  3) MESP P    1(  3,  1)
 SA       1(  4,  2) SALI X1   1(  4,  2) SALI X6   1(  5,  2)
*******************************************************************************************************************************
ODIVISION   46  (N=   3)          I.E. GROUP *01110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   47  (N=   4)          I.E. GROUP *01111
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   48  (N=   1)          I.E. GROUP *10000
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   49  (N=   4)          I.E. GROUP *10001
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   50  (N=  11)          I.E. GROUP *10010
 EIGENVALUE  .271  AT ITERATION   2
 INDICATORS, TOGETHER WITH THEIR SIGN
 COST      1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP     0
OITEMS IN NEGATIVE GROUP 100   (N=     4)           I.E. GROUP *100100
 PLOT431   PLOT432   PLOT435   PLOT436
OITEMS IN POSITIVE GROUP 101   (N=     7)           I.E. GROUP *100101
 PLOT405   PLOT406   PLOT516   PLOT518   PLOT527   PLOT538   PLOT604
OBORDERLINE POSITIVES       (N=     1)
 PLOT538
ONEGATIVE PREFERENTIALS
 ALTE     1(  3,  2) COST      1(  4,  0) FUNK 6    1(  1,  0) GUNK 3    1(  1,  0) GUNK 5    1(  1,  0) MESP P    1(  1,  0)
 RUPA     1(  1,  0) SALI X3   1(  4,  3) SALI X4   1(  1,  0)
OPOSITIVE PREFERENTIALS
 ASFO     1(  0,  2) GUNK 8    1(  0,  4) POPA      1(  0,  2)
ONON-PREFERENTIALS
 CISP P   1(  1,  1) CW        1(  4,  7) EQAR      1(  3,  7) GUNK 4    1(  1,  2) SALI X1   1(  4,  6) SALI X6   1(  4,  5)
 SALI X7  1(  2,  2)
*******************************************************************************************************************************
ODIVISION   51  (N=   3)          I.E. GROUP *10011
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   62  (N=   2)          I.E. GROUP *11110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
*******************************************************************************************************************************
ODIVISION   63  (N=   5)          I.E. GROUP *11111
 EIGENVALUE  .250  AT ITERATION   1
 INDICATORS, TOGETHER WITH THEIR SIGN
```

Figure 45. Continued.

```
 SALI X6  1(-)
 MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0
0ITEMS IN NEGATIVE GROUP 126  (N=    2)          I.E. GROUP *111110
 PLOT404   PLOT606
0ITEMS IN POSITIVE GROUP 127  (N=    3)          I.E. GROUP *111111
 PLOT401   PLOT402   PLOT514
0NEGATIVE PREFERENTIALS
 EQAR      1(  1,  0) SALI X6  1(  2,  0)
0POSITIVE PREFERENTIALS
0NON-PREFERENTIALS
 CW        1(  2,  2) SALI X7  1(  2,  2)
0   END OF LEVEL   6


0THIS IS THE END OF THE DIVISIONS REQUESTED
 ********************************************************************************************************************************
1
 ********************************************************************************************************************************
0DIVISION    1  (N= 57)        I.E. GROUP *
 EIGENVALUE  .561  AT ITERATION   2
0ITEMS IN NEGATIVE GROUP   2  (N=   43)        I.E. GROUP *0
  ACGL       ACMI       AMAL       ANAR       ASFO       BERE       BI         BRIN       CARE X1    CERE       CHLE
  CISP P     COST       DF         ES         FRVI       FUNK 4     FUNK 5     GUNK 12    GUNK 3     GUNK 5     GUNK 6
  GUNK 7     LA         MEAL       MEOF       MESP P     OPHO       PHPR       PTAQ       RIIN       ROWO       RUPA
  RUST       SA         SALI X5    SARA       SHCA       SMRA       SOCA       SYAL       TAOF       WWP
0ITEMS IN POSITIVE GROUP   3  (N=   14)        I.E. GROUP *1
  ALTE       ASMO       CW         EQAR       FUNK 6     GUNK 1     GUNK 4     GUNK 8     POPA       SALI X1    SALI X3
  SALI X4    SALI X6    SALI X7
0   END OF LEVEL   1


 ********************************************************************************************************************************
0DIVISION    2  (N= 43)        I.E. GROUP *0
 EIGENVALUE  .408  AT ITERATION   2
0ITEMS IN NEGATIVE GROUP   4  (N=   28)        I.E. GROUP *00
  ACGL       AMAL       ANAR       BERE       CARE X1    CISP P     COST       DF         ES         FRVI       FUNK 4
  FUNK 5     GUNK 12    GUNK 5     GUNK 7     LA         MEOF       OPHO       PTAQ       RIIN       ROWO       RUPA
  RUST       SA         SARA       SHCA       SMRA       SYAL
0ITEMS IN POSITIVE GROUP   5  (N=   15)        I.E. GROUP *01
  ACMI       ASFO       BI         BRIN       CERE       CHLE       GUNK 3     GUNK 6     MEAL       MESP P     PHPR
  SALI X5    SOCA       TAOF       WWP
 ********************************************************************************************************************************
0DIVISION    3  (N= 14)        I.E. GROUP *1
 EIGENVALUE  .434  AT ITERATION   3
0ITEMS IN NEGATIVE GROUP   6  (N=   10)        I.E. GROUP *10
  EQAR       FUNK 6     GUNK 1     GUNK 4     POPA       SALI X1    SALI X3    SALI X4    SALI X6    SALI X7
0ITEMS IN POSITIVE GROUP   7  (N=    4)        I.E. GROUP *11
  ALTE       ASMO       CW         GUNK 8
0   END OF LEVEL   2
```

Figure 45. Continued.

```
****************************************************************************************************************
ODIVISION    4  (N=  28)          I.E. GROUP *00
 EIGENVALUE  .272  AT ITERATION   2
OITEMS IN NEGATIVE GROUP   8  (N=   20)          I.E. GROUP *000
  ACGL        AMAL        ANAR        BERE        CARE X1     FRVI        FUNK 4      FUNK 5      GUNK 12     GUNK 7      LA
  MEOF        OPHO        PTAQ        RIIN        RUPA        RUST        SARA        SMRA        SYAL
OITEMS IN POSITIVE GROUP   9  (N=    8)          I.E. GROUP *001
  CISP P      COST        DF          ES          GUNK 5      ROWO        SA          SHCA
****************************************************************************************************************
ODIVISION    5  (N=  15)          I.E. GROUP *01
 EIGENVALUE  .339  AT ITERATION   2
OITEMS IN NEGATIVE GROUP  10  (N=    7)          I.E. GROUP *010
  ACMI        BRIN        CERE        CHLE        MESP P      PHPR        TAOF
OITEMS IN POSITIVE GROUP  11  (N=    8)          I.E. GROUP *011
  ASFO        BI          GUNK 3      GUNK 6      MEAL        SALI X5     SOCA        WWP
****************************************************************************************************************
ODIVISION    6  (N=  10)          I.E. GROUP *10
 EIGENVALUE  .478  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  12  (N=    5)          I.E. GROUP *100
  EQAR        FUNK 6      GUNK 1      GUNK 4      POPA
OITEMS IN POSITIVE GROUP  13  (N=    5)          I.E. GROUP *101
  SALI X1     SALI X3     SALI X4     SALI X6     SALI X7
****************************************************************************************************************
ODIVISION    7  (N=   4)          I.E. GROUP *11
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
0   END OF LEVEL   3


****************************************************************************************************************
ODIVISION    8  (N=  20)          I.E. GROUP *000
 EIGENVALUE  .196  AT ITERATION   2
OITEMS IN NEGATIVE GROUP  16  (N=   17)          I.E. GROUP *0000
  ACGL        AMAL        ANAR        BERE        CARE X1     FRVI        FUNK 4      GUNK 12     GUNK 7      OPHO        PTAQ
  RIIN        RUPA        RUST        SARA        SMRA        SYAL
OITEMS IN POSITIVE GROUP  17  (N=    3)          I.E. GROUP *0001
  FUNK 5      LA          MEOF
****************************************************************************************************************
ODIVISION    9  (N=   8)          I.E. GROUP *001
 EIGENVALUE  .273  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  18  (N=    6)          I.E. GROUP *0010
  DF          ES          GUNK 5      ROWO        SA          SHCA
OITEMS IN POSITIVE GROUP  19  (N=    2)          I.E. GROUP *0011
  CISP P      COST
****************************************************************************************************************
ODIVISION   10  (N=   7)          I.E. GROUP *010
 EIGENVALUE  .160  AT ITERATION   2
OITEMS IN NEGATIVE GROUP  20  (N=    4)          I.E. GROUP *0100
  ACMI        BRIN        CERE        PHPR
OITEMS IN POSITIVE GROUP  21  (N=    3)          I.E. GROUP *0101
  CHLE        MESP P      TAOF
****************************************************************************************************************
```

Figure 45. Continued.

```
ODIVISION   11  (N=   8)          I.E. GROUP *011
 EIGENVALUE  .304  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  22  (N=    3)          I.E. GROUP *0110
  BI         GUNK 3      SALI X5
OITEMS IN POSITIVE GROUP  23  (N=    5)          I.E. GROUP *0111
  ASFO       GUNK 6      MEAL        SOCA        WWP
**************************************************************************************************************************************
ODIVISION   12  (N=   5)          I.E. GROUP *100
 EIGENVALUE  .505  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  24  (N=    2)          I.E. GROUP *1000
  GUNK 4     POPA
OITEMS IN POSITIVE GROUP  25  (N=    3)          I.E. GROUP *1001
  EQAR       FUNK 6      GUNK 1
**************************************************************************************************************************************
ODIVISION   13  (N=   5)          I.E. GROUP *101
 EIGENVALUE  .178  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  26  (N=    4)          I.E. GROUP *1010
  SALI X1    SALI X3     SALI X6     SALI X7
OITEMS IN POSITIVE GROUP  27  (N=    1)          I.E. GROUP *1011
  SALI X4
0   END OF LEVEL   4


**************************************************************************************************************************************
ODIVISION   16  (N= 17)          I.E. GROUP *0000
 EIGENVALUE  .142  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  32  (N=    3)          I.E. GROUP *00000
  CARE X1    RUPA        SARA
OITEMS IN POSITIVE GROUP  33  (N=   14)          I.E. GROUP *00001
  ACGL       AMAL        ANAR        BERE        FRVI        FUNK 4      GUNK 12     GUNK 7      OPHO        PTAQ        RIIN
  RUST       SMRA        SYAL
**************************************************************************************************************************************
ODIVISION   17  (N=   3)          I.E. GROUP *0001
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
**************************************************************************************************************************************
ODIVISION   18  (N=   6)          I.E. GROUP *0010
 EIGENVALUE  .179  AT ITERATION   1
OITEMS IN NEGATIVE GROUP  36  (N=    2)          I.E. GROUP *00100
  GUNK 5     ROWO
OITEMS IN POSITIVE GROUP  37  (N=    4)          I.E. GROUP *00101
  DF         ES          SA          SHCA
**************************************************************************************************************************************
ODIVISION   19  (N=   2)          I.E. GROUP *0011
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
**************************************************************************************************************************************
ODIVISION   20  (N=   4)          I.E. GROUP *0100
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
**************************************************************************************************************************************
ODIVISION   21  (N=   3)          I.E. GROUP *0101
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
**************************************************************************************************************************************
```

Figure 45. Continued.

```
0DIVISION    22  (N=   3)          I.E. GROUP *0110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    23  (N=   5)          I.E. GROUP *0111
 EIGENVALUE  .211  AT ITERATION   1
0ITEMS IN NEGATIVE GROUP  46  (N=    4)         I.E. GROUP *01110
  ASFO       GUNK 6     MEAL       WWP
0ITEMS IN POSITIVE GROUP  47  (N=    1)         I.E. GROUP *01111
  SOCA
 ************************************************************************************************************************
0DIVISION    24  (N=   2)          I.E. GROUP *1000
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    25  (N=   3)          I.E. GROUP *1001
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    26  (N=   4)          I.E. GROUP *1010
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    27  (N=   1)          I.E. GROUP *1011
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
0   END OF LEVEL   5


 ************************************************************************************************************************
0DIVISION    32  (N=   3)          I.E. GROUP *00000
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    33  (N= 14)           I.E. GROUP *00001
 EIGENVALUE  .099  AT ITERATION   1
0ITEMS IN NEGATIVE GROUP  66  (N=    6)         I.E. GROUP *000010
  FUNK 4     GUNK 12    OPHO       PTAQ       RIIN       SMRA
0ITEMS IN POSITIVE GROUP  67  (N=    8)         I.E. GROUP *000011
  ACGL       AMAL       ANAR       BERE       FRVI       GUNK 7     RUST       SYAL
 ************************************************************************************************************************
0DIVISION    36  (N=   2)          I.E. GROUP *00100
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    37  (N=   4)          I.E. GROUP *00101
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    46  (N=   4)          I.E. GROUP *01110
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
 ************************************************************************************************************************
0DIVISION    47  (N=   1)          I.E. GROUP *01111
 DIVISION FAILS - THERE ARE TOO FEW ITEMS
0   END OF LEVEL   6


0THIS IS THE END OF THE DIVISIONS REQUESTED
 ************************************************************************************************************************
```

Figure 45. Continued.

ORDER OF SPECIES INCLUDING RARER ONES

11 CARE X1	42 RUPA	51 SARA	21 FUNK 4	25 GUNK 12	36 OPHO	39 PTAQ	40 RIIN
53 SMRA	1 ACGL	4 AMAL	5 ANAR	8 BERE	20 FRVI	30 GUNK 7	43 RUST
55 SYAL	22 FUNK 5	32 LA	34 MEOF	28 GUNK 5	41 ROWO	17 DF	19 ES
44 SA	52 SHCA	14 CISP P	15 COST	2 ACMI	10 BRIN	12 CERE	37 PHPR
13 CHLE	35 MESP P	56 TAOF	9 BI	26 GUNK 3	48 SALI X5	6 ASFO	29 GUNK 6
33 MEAL	57 WWP	54 SOCA	27 GUNK 4	38 POPA	18 EQAR	23 FUNK 6	24 GUNK 1
45 SALI X1	46 SALI X3	49 SALI X6	50 SALI X7	47 SALI X4	3 ALTE	7 ASMO	16 CW
31 GUNK 8							

ORDER OF SAMPLES

108 PLOT511	109 PLOT512	110 PLOT513	92 PLOT427	93 PLOT428	87 PLOT422	156 PLOT621	46 PLOT225
44 PLOT223	45 PLOT224	47 PLOT226	65 PLOT318	66 PLOT319	67 PLOT320	42 PLOT221	43 PLOT222
62 PLOT315	63 PLOT316	20 PLOT124	21 PLOT125	41 PLOT220	64 PLOT317	91 PLOT426	107 PLOT507
158 PLOT623	89 PLOT424	90 PLOT425	105 PLOT442	94 PLOT429	137 PLOT543	144 PLOT609	174 PLOT640
175 PLOT641	78 PLOT413	81 PLOT416	82 PLOT417	106 PLOT443	136 PLOT542	146 PLOT611	147 PLOT612
148 PLOT613	15 PLOT119	16 PLOT120	17 PLOT121	18 PLOT122	19 PLOT123	80 PLOT415	143 PLOT608
145 PLOT610	167 PLOT632	168 PLOT633	3 PLOT107	9 PLOT113	10 PLOT114	11 PLOT115	22 PLOT201
23 PLOT202	24 PLOT203	25 PLOT204	26 PLOT205	27 PLOT206	28 PLOT207	29 PLOT208	30 PLOT209
31 PLOT210	32 PLOT211	33 PLOT212	34 PLOT213	36 PLOT215	37 PLOT216	38 PLOT217	39 PLOT218
48 PLOT301	55 PLOT308	56 PLOT309	57 PLOT310	58 PLOT311	59 PLOT312	60 PLOT313	149 PLOT614
151 PLOT616	153 PLOT618	2 PLOT106	5 PLOT109	6 PLOT110	7 PLOT111	8 PLOT112	35 PLOT214
50 PLOT303	51 PLOT304	52 PLOT305	53 PLOT306	54 PLOT307	86 PLOT421	88 PLOT423	131 PLOT534
173 PLOT639	40 PLOT219	61 PLOT314	74 PLOT409	77 PLOT412	85 PLOT420	142 PLOT607	150 PLOT615
154 PLOT619	155 PLOT620	157 PLOT622	122 PLOT525	128 PLOT531	129 PLOT532	133 PLOT536	134 PLOT537
152 PLOT617	76 PLOT411	99 PLOT434	103 PLOT438	117 PLOT520	125 PLOT528	126 PLOT529	130 PLOT533
160 PLOT625	161 PLOT626	162 PLOT627	163 PLOT628	4 PLOT108	118 PLOT521	119 PLOT522	121 PLOT524
165 PLOT630	166 PLOT631	123 PLOT526	132 PLOT535	164 PLOT629	79 PLOT414	83 PLOT418	84 PLOT419
1 PLOT105	49 PLOT302	75 PLOT410	159 PLOT624	127 PLOT530	104 PLOT439	120 PLOT523	169 PLOT635
171 PLOT637	96 PLOT431	97 PLOT432	100 PLOT435	101 PLOT436	72 PLOT405	73 PLOT406	113 PLOT516
115 PLOT518	124 PLOT527	135 PLOT538	140 PLOT604	95 PLOT430	98 PLOT433	114 PLOT517	12 PLOT116
13 PLOT117	14 PLOT118	172 PLOT638	102 PLOT437	116 PLOT519	112 PLOT515	138 PLOT601	139 PLOT602
70 PLOT403	170 PLOT636	71 PLOT404	141 PLOT606	68 PLOT401	69 PLOT402	111 PLOT514	

1

```
            111   1                1  1 1111   11111      1111                           111              11
            001998544446664466224690589093477788034441111184466  1122222222333333334555556455      3555558837467
            8902376645756723230114178905474458126667856789035783901234567890123467898567890913256785012346813014

11 CARE X1  -------1-11111----------1----1---1-1-1--------------------------------------------------------------  00000
42 RUPA     ---11111111111111111111-1111---11--11--1111111-----------------------1-----------1---------11-1--11-  00000
51 SARA     -----1--1-11-11111111------------1-------11111-----------------------------------------------1---11-  00000
21 FUNK 4   -------1------11-1---1------------------------------------------------------------------------------  000010
25 GUNK 12  --------11111-1--------------------1----------------------------------------------------------------  000010
36 OPHO     -------1111111-1-1-1-1------------------------------------------------------------------------------  000010
39 PTAQ     -------1-1-11------1-1-------------1----------------------------------------------------------------  000010
40 RIIN     -----------11---11-----------1-----1-1-11-----------------------------------------------------------  000010
53 SMRA     -------1-11----11-11-------1----------1-------------------------------------------------------------  000010
 1 ACGL     -------111111111111111---1---11--111111--1111-1-1---11---------11-1-1111-11-111------11-111111---11-  000011
```

Figure 45. Continued.

```
 4 AMAL     ---1----------1111---------1-1111---111--1111---1------------------------1-------1-----1-11-1--1-11-  000011
 5 ANAR     ----------------------1----------1-1-1-----1-----------------------1---------------1------------  000011
 8 BERE     -----------------------------11----------11----1------------------------------------1--------  000011
20 FRVI     ------1-----------1---------1------------11-------1--------------------11--------------------  000011
30 GUNK 7   --------1--1-1--------------------------1-11-------------------------------------------------  000011
43 RUST     ---11111-1-11---11----1-111-11---------------------------------------------1-------------1---11  000011
55 SYAL     -----1-1--111111111111--1-11111111111-1111111111---------------111---------1---1---11----11--1-111  000011
22 FUNK 5   -----1--------------------------------1----------------------------------------------1-----  0001
32 LA       ----1----------------------------------1--1---1----11-----111111-1111-----1---1-1--------------1----  0001
34 MEOF     -------------------------1-----------------------1------------------------------1---1-----------------1-  0001
28 GUNK 5   -------1-1-1-1--1------------111-11-1---11-------------------------1-----------------------------1--1--  00100
41 ROWO     -----------1111----1----1111-111-111-1111--11--11------------------------------1-------11-----11---1  00100
17 DF       -------------------1---------111111---1111--1111-1---11-----11111111111-1--11111-11-----1--111--------  00101
19 ES       -----1-1-111111111-1-11--11-11-1-11111111--1111-1--1111111111111111111111-111111111---111-111111---1-  00101
44 SA       -------11111111-111111--1---111-1111-1111-1111111-----------111111111-1-111111111-----1-111111-----  00101
52 SHCA     ---------------------------1111111--111--1----------1-1----11---1-11-----1---1--------11------1------  00101
14 CISP P   ------11-----------1---1111111----1-1--1--1--11------------------------------1---------1------1--  0011
15 COST     ---11111111111-11111-111-11111111111111111111-1111---11----------1-1---------1---1-1-11-1111111111--1-  0011
 2 ACMI     --------------------------------------------------------1--1---1---1----1------------------------------  0100
10 BRIN     -------------------------------------------------------------------------------------------------  0100
12 CERE     ---------------------------------------------------------------11---11-11-11-11111---1---------11-------  0100
37 PHPR     ------11-----1-------------------1----------1------1---1-1-1----1----11---11-111---1--1----11-1--11-  0100
13 CHLE     -------------------------1--------------1-----------1----1111-11----1-1---11111---------------------1  0101
35 MESP P   ---1------------------------1----------------1-1---11---------11------------1-------1--1-1-------  0101
56 TAOF     ---------------------------------------------------1--1-1----1-111--1-1--1---1---1---11---111------  0101
 9 BI       ---------------1---1-------1--11--1---------------------1------------------------11---------------111----  0110
26 GUNK 3   -----11-111----------------1--1-----11--1111-1-------111-------------------------11--111----1111-1---1-  0110
48 SALI X5  -----11---------1------------------------------1-------------------1---------1-------1-----------  0110
 6 ASFO     -------1---------------------1--11-11111-11-------11111111111111111-11-111-11--1-111-1111-111-1---1-  01110
29 GUNK 6   ------------------1------------1-1---1---1----------1---1-11----1--1-1---111--11------------------1--  01110
33 MEAL     ----------------------------------------------------1-1----11111111--1111--111-1--1-----------------11-  01110
57 WWP      ------------------------------------------1-------------------11-11-1111-----1------1-----1--111-11----  01110
54 SOCA     -------------------------------------------------------------------------------1----------1--------1-  01111
27 GUNK 4   -----------------------------1-------1-----1--1------------------------------1--------------------  1000
38 POPA     ---1-------1-1-------------------11----1------1-------------------1-------------------1--------------------1--  1000
18 EQAR     1111111111111111111111---1111-----111-1-1--------------1--------------1-----------1-------1---1------  1001
23 FUNK 6   ----1-1-------------------1------1-------------------------------------------------------------  1001
24 GUNK 1   ---------1-1-1---------------1-------------1------1-1--------------------------11-----------1--  1001
45 SALI X1  ------1-------------1------------1----------1----------1----------------------------------------  1010
46 SALI X3  ----------------------------------------1-------------------------------------------------------  1010
49 SALI X6  ----------------------------1-------------------------------------------------------------------  1010
50 SALI X7  -------------------------------------------------------------------------------------------------  1010
47 SALI X4  --------------------------------------1---11---------------------------1-1-------------1------------  1011
 3 ALTE     --------------------------11111-11--11---1------------1--1---------11--11-----1-1-11-----1--111-1--1---  11
 7 ASMO     -------------------------------------1-------------1---1-------------------------------------  11
16 CW       ---11-1---------1-1-----------1-11-----------------111111111111111111111111111111--11111111111111-1--11  11
31 GUNK 8   -------1--------------1-1--------------------------------1---11-1-1--1-11-1-1111----------1----------11-  11

            0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
            0000000000000000000000000000000000000000000000000011111111111111111111111111111111111111111111111111
            0000000000000000000000111111111111111111111111110000000000000000000000000000000000000000000000000000
```

Figure 45. Continued.

```
0000000111111111111111111000000111111111111111011111111111111111111111111111111111111111111111111111
                0000011000000001111111100011100000000000011111111 00000000000000000000000000000011111111111111111111
                00011  011111100001111      000001111111100000111 01111111111111111111111111111111100000000000000111
1

                  11111111111  111111111 11111111      111111  11  11111  1   111111 1 1  1
                784555522233579012236666 11266236788 47520267990077112349911117011337774661
                752045728934269375600123489156324934195974091670123354505842342262890011891

   11 CARE X1   --------------------------------------------------------1------------------  00000
   42 RUPA      ----11--11---1-----11-------------1-------------1--------------1-----------  00000
   51 SARA      1--------1-----------------------------------------------------1-----------  00000
   21 FUNK 4    ---------------------------------------------------------------------------  000010
   25 GUNK 12   ---------------------------------------------------------------------------  000010
   36 OPHO      ---------------------------------------------------------------------------  000010
   39 PTAQ      ---------------------------------------------------------------------------  000010
   40 RIIN      ---------------------------1-----------------------------------------------  000010
   53 SMRA      ---------------------------------------------------------------------------  000010
    1 ACGL      11-----------1-1----1------------11-----------------------------1----------  000011
    4 AMAL      -11-----11-----------------------------------------------------------------  000011
    5 ANAR      ---------------------------------------------------------------------------  000011
    8 BERE      1---------1----------------------------------------------------------------  000011
   20 FRVI      -1------------------------------------1------------------------------------  000011
   30 GUNK 7    ------1-----1-------------------------1------------------------------------  000011
   43 RUST      -1--111--------------------------------------------------------------------  000011
   55 SYAL      11--1-1--1-111-------1-1------1-1-1---11-----------------------------------  000011
   22 FUNK 5    ----1-------1--------------------------------------------------------------  0001
   32 LA        -------1-----------------1--------1----------------------------------------  0001
   34 MEOF      -11-11---------------1------------1---11-----------------------------------  0001
   28 GUNK 5    --------------11------1----------11-1-1--------1---------------------------  00100
   41 ROWO      1--------1---11----1---1111---1--1--1111-----------------------------------  00100
   17 DF        -------111-1-1-11--11-11-----111-1-----------------------------11----------  00101
   19 ES        -1--1--111111-111-1111--111111111111---1--1--------------------11----------  00101
   44 SA        11--1-1-11-11-111--111---11-11-11-1----1-1---------------1-----11----------  00101
   52 SHCA      1---------1---------1--------1---------1------------------------1----------  00101
   14 CISP P    11--11--1-111---------------1--1-1-11-11------1-------1----1---------------  0011
   15 COST      11-11--1111-1-111-111---1-1111-1-1111--11-1--1111-------11-111-------------  0011
    2 ACMI      1---1----------------------------------------------------------------------  0100
   10 BRIN      -------------11------111----11--1------------------------------------------  0100
   12 CERE      ------1----------------1---------------------------------------------------  0100
   37 PHPR      11-1-11111---11111-1111---1--1----11---1-----------------------------------  0100
   13 CHLE      1-11------------------------------11-----------------------1---------------  0101
   35 MESP P    ------1------------------1--111---------------1----------------------------  0101
   56 TAOF      -----------------------1-------1--------------------------------1----------  0101
    9 BI        -------111-1-------------11----1----------1--------------1-----------------  0110
   26 GUNK 3    1---1--------1----------1-1111-----------------1---------1------1----------  0110
   48 SALI X5   -1---1----1-----------------------1-----1----------------------------------  0110
    6 ASFO      -1---1--11---1--111-11--1---11-11-1-1-11-----------1-1--1111---------------  01110
   29 GUNK 6    ----11---111--11---1--11--1---11---1--------------------111----------------  01110
   33 MEAL      1--11--11-1-11-111111-11----------11----1----------------------11----------  01110
   57 WWP       ----1--111-11--11---1-1-1---1-----------------------1-----------1----------  01110
```

Figure 45. Continued.

```
54 SOCA      -------1--1---111-1-1111--1--1111-1111-------------------------1-1---------  01111
27 GUNK 4    ---1----11--------1-----------111-11-----------1--11----------------------  1000
38 POPA      -------1-111-1-1----1--------1---------------------11----------------------  1000
18 EQAR      -1-1---11-11---1-111-1--1-111-1--11----1-----111-1111111----1----------1---  1001
23 FUNK 6    ------------1------------1-------------------1----------------------------  1001
24 GUNK 1    -----1--------1---1----------------------------------1-11----------------  1001
45 SALI X1   -------1---1--1111--11-1-11-111-1------1-11111111-1111111111111111-111-----  1010
46 SALI X3   ----------------1--------11--1--------------1111--111--1-1111--1111-------  1010
49 SALI X6   -------111111-111--1-111-111111-1------1111111111--11111111----111-11111---  1010
50 SALI X7   --------1--1------------------------------------11--1--1---1----1111111111-1  1010
47 SALI X4   --------------1-----1----------------1---------1-----------111------------  1011
 3 ALTE      -11-----11111--11---1---111--1-1---------11--111----1-1-1-----------------  11
 7 ASMO      --1--1-1-11--------------------------11-----------1----1-----------------  11
16 CW        1111-1-11111--11111111111111111111--111111-1-11111111111111----111-1111111-  11
31 GUNK 8    1-11111111111-11111111------------11---1-----------1-1111-1----1-----------  11

             00000000000000000000000000000000000000001111111111111111111111111111111111
             11111111111111111111111111111111111111111000000000000000000000001111111111111
             00000001111111111111111111111111111111111100000000000000000000001111001111111111
             1111111000000000000000000000000000111111100000111111111111111       0001111111
             11111110000000000000000001111111110001111011110000000000000111        0011111
             1111111000000111111111111000000111              00001111111            00111
```

Figure 45. Continued.

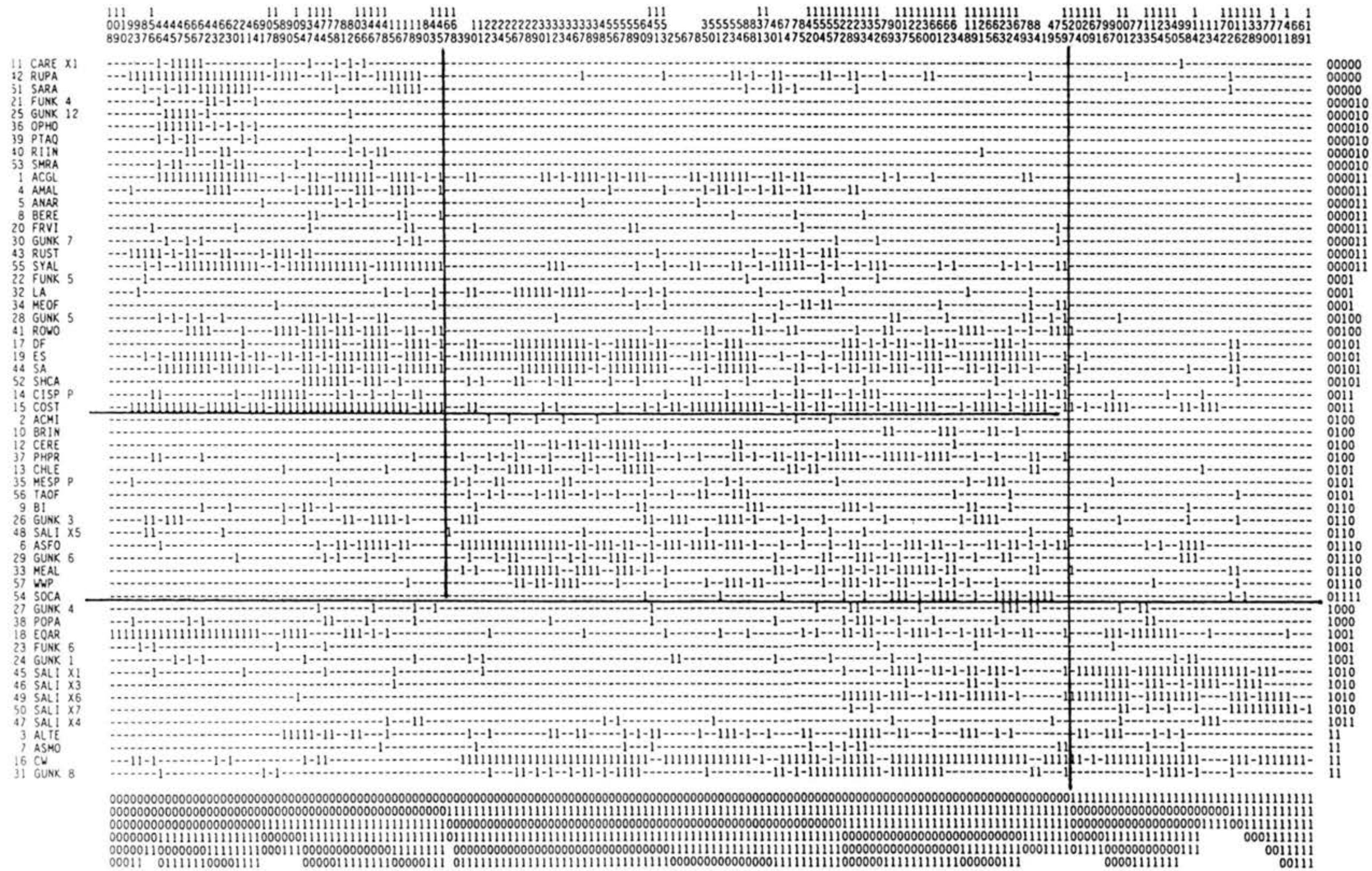

Figure 46. TWINSPAN site-by-species two-way classification table for presence/absence data, all species, all sites.

```
                          1                                     11111 1111111  1111111   1 1111111                      1111                             111111111111111     111111  11111111     11111 1          1 1 11
                          1114112446660244467446668888899994555490222567783334444777050445565    12223335556788882224355 23335552223336611111266113559999000123770123366691116003315      24747341266
                          78925600121361347785656423789012370344455675907123901234562338967014780235589012090456248574569612678978903438345689122908956781890010341156456923470748121235648261797389

  8 COST                  2-31521-23331-122-32233321133433331-3245324252224424422---+212-4---2131---1--122111112335--2-11--1-------1---+2-123322-----22452---------------5354-5----221-1----1---32--   000
  5 BERE                  1----2--------------------------------------3--5-31-----+1---------------------------------------------------+------1--------------------------------------------------------   0010
 17 RIIN                  ---------1-2---------11-1------------1----------12----2--+---------------------------------------------------+----------------------------------------------------------1---   0010
 18 ROWO                  32-3---------1---22--11-32-251------13-555333-215224324413+--------2------1--1---------12--------------------+-21---------------------------3--------------------542--   0010
  7 CE                    -----------------------1---------1--11-------------------+---------------------------------------------------+--------------------------------------------------------------   001100
 15 PAMY                  -----------------------3-----------1--1----1-------------+---------------------------------------------------+--------------------------------------------------------------   001100
 19 RUPA                  554455535545544333-33545331143322-3-12-541--44--------1--1+12--12--3-------------------1--33-----------------+------------------2---------------------------3-----------------   001100
 20 RUST                  ---------211--------2212---13354534235-1----------3-----1--+-------2----------------1--------------------------+-------------------------------------------2-----------------   001100
 33 SYAL                  544555455545513-223-1334431--2----2223251-14242253231-2235+1-22-12--11-----------1-1------1----11---1----1-+---------12-1-------------------------------------------------   001100
 38 LP                    ---------------------------1---------------------------------+---------------------------------------------------+--------------------------------------------------------------   001100
 14 OPHO                  -----------1-43534-23444--------------------------------+---------------------------------------------------+--------------------------------------------------------------   001101
 30 SARA                  553555525525-454354--1----1------------2-----1----------5-------------------------1---------------------------+--------------------------------------------------------------   001101
 34 VAGL                  ---------1----------------------------------------------+---------------------------------------------------+--------------------------------------------------------------   001101
 35 WH                    -----------2--------------------------------------------+---------------------------------------------------+--------------------------------------------------------------   001101
 37 ACRU                  ---------------------2----------------------------------+---------------------------------------------------+--------------------------------------------------------------   001101
  1 ACGL                  44-22232332313213233422231--1-------------------2213-222---2+21--1----122----12223212-12----22322-2-2-11---21--+---------2----------------------------------------------------   00111
  3 AMAL                  21-213-3-3214-1-----------------1-------11-1-13--31-111---+----2----------1---32----1--1---23---------------+--------------------------------------------3-------------------   00111
  ______________________________________________________________________________________________________________________________________
  4 ARUV                  --------------------------------------------------------+--1------------------------------------------------+--------------------------------------------------------------   01000
 16 PRVI                  --------------------------------------------------------+---------------------2--------------1---------------+--------------------------------------------------------------   01000
 11 DF                    222----------2----1--------------1---11-12--22--43-1111--1222-11------1---2-1--2121----11-25-223223223434432-+-2---2--211122-------------------------------------------------   01001
 12 ES                    2111-----141122-211221344433112--22--52-33-22--312--123---+25531444-2232222425-344221452354555555555555545555-+-53222235233--------------------2--------1---1--1------2---   01001
 13 LA                    2-----------------------1------1----2----1-------1---------+---2-------2-------------------11---111-11--321222-+--1--2--------------------------------------------------------   01001
 26 SALI X5               ---------1--------------12-------------------------------+---------1-------1----------1----21-------------------1+------1--------------------------------------1-----------1--   0101
 32 SPBE                  -----2--------------------------------------------------+----------1--------------------------------2--+--------------------------------------------1-----------------   0101
  6 BI                    -----------1-----1---------11----------1-1-2--1---2--------+-------------1----------1----1-24------------1-------+-2111-----1-----1----------------------------------------------   011
 21 SA                    3212-12-12-1-3-32233233333-1-----121142-32-3-1412412122---+24513333---------3-3-231-1-22-1223434--343322222443-+-221---241-2-----1---------2-------3------------------------   011
 31 SHCA                  -----1-----------1------------------1---2132122-1-32-----+-----1---11---------------1-------2-122---11---11-+------1-11--------------------------------2----------------   011
  ______________________________________________________________________________________________________________________________________→
 10 CW                    ----------11--1-----------------21-----1-22211-1----2---41-342-21353555355552344441--22443-5443555553445555555-+-232-3432454131423344443222322221-1----2--4454555554424544511   10
 36 WWP                   1-------------------------1------1-----1-1-----------------1211-1---------1----1-------1---2-3-1-22---2-2222-+-21--1--12-1-2--------------1---------------------------------   10
  2 ALTE                  ------------2-----------1---21---1---2222---31---1----------222-1---1-1-1------33----21-1211---2-1111-1-------+12231-2-1--2--342------2--22-----------1--1------------------   110
  9 CRDO                  ------------------------------------1--------------------+---------------------------------------------------+--------------------------------------2-----------------   1110
 25 SALI X4               -11-----------------------2-------------------------2-----------1------------------1--------------------------+-------------------------------1132-1-----------1----2----   1110
 29 SALI X8               --------------------------------------------------------+---------------------------------------------------+------------------------------------------------------1--   1110
 22 SALI X1               ----1--------1-----------------------11-------------2-4--243---------------------------------------------------+-52312-23354-232443353551223221312222323---22------------------   11110
 23 SALI X2               --------------------------------------------------------+---------------------------------------------------+---------------11-2-----------------2------------------------   11110
 24 SALI X3               ----2---------------------------------------------------+---------------------------------------------------+-223----21----243-22313----1-2-----222-4-3-------------------   11110
 27 SALI X6               ---------------------------231-1-------------4-51--13---------------------2------------------------------------+-543232544441242545454531-44-222443----2--------------12-41--   11110
 28 SALI X7               -------------------------------------------1----------------------------1--------------------------------------+---------2-1------3432-31----2--1------212-----------13---2-   11111

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                          0000111111111000000000001110111111111110000000000111111111111000000000111111111111111111111111110000111111111111111 0111111111111100000111111111111111111011111   0111111111111100111
                              0000000111000000001111      001111111110111111111000000000011101111111101111111111111111111111111          00000000111111   000000001111100001000001111111111 00001    0011111111
```

Figure 47. TWINSPAN site-by-species two-way classification table for density data for all tree and shrub species.

```
                                                                                11                         1  111  1   11 1111 1111        1
              47 555      6881377222333355554 222223    333555324464466681124446678800111467888899990770017809191160011900117999111671
              941012245602300566781789678983245934789236345514745656716701232390545589017467901236188903878174690123423572569234801

 19 COST     --1111311-11111-1-------1-----------1111--11-1-1144132-212111132111313-1-3211354322--1----4-5-2---1---11--1-112121---   000
 21 EQAR     ----1--1---1---------1-------1--------------1221222111--111112-2121------11-1-112-11111-1----------1-1-1-1111-1----   000
 33 GUNK 5   1---------1------------------------1--------111-11------1---------1-1--1----1--1------1----------1------1------   000
 14 CARE X1  ----------------------------------------------1-313332-----------------2-------------------------1-------------   001000
 23 FUNK 3   ---------------------------------------------------2-----1-------------------------------------------------------   001000
 30 GUNK 12  ----------------------------------------------11-1-11-1----1------------------------------------------------------   001000
 37 HELA     ----------------------------------------------3--2-2---------------------------------------------------------------   001000
 43 OPHO     ---------------------------------------------352413322------2-1---------------------------------------------------   001000
 44 PAMY     ------------------------------------------------------1--------------------------------------------------------   001000
 48 PTAQ     ---------------------------------------------1--13222-1--------------------------------------------------------   001000
 49 RIIN     ----------------------------------------------------11-1-----11-----------------------------------------------   001000
 61 SESE     -----------------------------------------------1--311-----------------------------------------------------------   001000
 66 STAM     -----------------------------------------------1--1--------------------------------------------------------------   001000
 69 THOC     ---------------------------------------------112---------1-----------------------------------------------------   001000
 73 ACRU     ----------------------------------------------------1------------------------------------------------------------   001000
  6 ANMA     ---------------------------------------------------------------------11------------------------------------------   001001
  7 ARCO     ---------------------------------------------------------1----------------------------------------------------   001001
 18 CLCO     --------------------------------------------------------2-----------------------------------------------------   001001
 24 FUNK 4   -----------------------------------------------1-1--------11-2------------------------------------------------   001001
 35 GUNK 7   -1-------------------------------------------1----1-1-1------------23----------------------------------------   001001
 60 SARA     ---------------1-----------------------------222---1-4-33324333--1--221112-1------------------1-----------------   001001
 63 SHRA     ---------------------------------------------2-3-11-----2--21----2---------------------------------------------   001001
 71 URDI     ----------------------------------------------1------------3---------------------------------------------------   001001
 72 VAGL     ---------------------------------------------------------------1-----------------------------------------------   001001
 25 FUNK 5   ------------------------------------------------------------------2--------1------------------------------------   001010
 51 RUPA     -----------1---1-----2-----------------11--3213122221223222 43---2423213--111111--------2------11---------------   001010
 27 FUNK 7   ------------------------------------------------------------------1-----------1---------------------------------   001011
 42 MULE IN  -------------------------------------------------------------------------------2--------1--------------------------   001011
 52 RUST     -----------------------------------------------1111--------11---------1-11121211------11-------------------------   001011
 70 TRIF OL  -------------------------------------------------------------------------------------------1-1-------------------------   001011
 17 CISP P   -11--1------1---2----------------------------------1---1--1--------1-1121-11--11--11-1----1-----------------1-1-----   001100
  4 AMAL     ----11-------------------------------------111----------21--3122---1211-22-1----1----------------------------   001101
  5 ANAR     -------------------1--------------1--------------1-2-------------------1----1----------------------------------   001101
 50 ROWO     11-1---1---1---21-------------------------11-----1112-2--1----1-2--1---1--11----------23-1-------------------   001101
 67 SYAL     -1---------1---22---1------1---------11-11-11--1-22-12112332342 3211-3322232111-1---1------1---------------------   001101
  1 ACGL     ---111----11-2212---12111-11--------112-12111-3121332231144441 35111-113-2111---------1----1----1------1-----------   00111
 22 FRVI     -1-----------1-----------11--------------------------------11---------1----1----------------------------------   00111
 12 BERE     ---------------1------------------------1-----------11-----------------------------------------------------------   01000
 40 MEOF     -2---------1----------------1---------------------------------------2-1-------------------------------------   01000
 57 SALI X5  ------------1---------1-------------------------1-----------------1-----------11-----------------------------------   01000
  8 ARIN     --1----------------------------------------------------------------------------------------------------------   010010
 16 CHLE     ----------23111-311112-1-211----1-----------------------------------------------------21------------------1-----   010010
 29 GUNK 10  --------------------2----------------------------------------------------------------------------------------   010010
 47 PRVI     ----1-----------------1---------------------------------------------------------------------------------------   010010
  2 ACMI     ----------------2------1------1-21------1----------------------------------------------------------------------   010011
 15 CERE     ------------------22-1-112211-------1---1-1111-----------------------------------------------------------------   010011
 39 MEAL     ----------21212332222222322--1--11-----1-1----------------------------22------------------------2--1---1-----------   01010
 45 PHPR     --------1-112--121--111-11-1-111-----1-----11-------1--1--------------1-1111-1-----------------1----------1-----------   01010
 10 ASFO     -111-1132--1-222-21111-1-11-2143312-1331112211-----1----21-------1--1---111-1--------------111-----11--------1-----   01011
 41 MESP P   -----1------------------------1--11--1-2--1-1----------------------------1-------------------------1-------   01011
 68 TAOF     ------1---1---------11-12-----11-1---1211-22-1------------------1---------------------------1---------------   01011
 31 GUNK 3   ----1111111--1-12--------------1--------1---11--11-1----2-2-------1---1---1--13----1-------1---3-1-----------1------   011
 62 SHCA     ---------------111-1------1-------1111-1---1---------1---------11-------1-------1--------------1--2-----------------   011
 20 DAGL     ---------------------------------------------1--------------------------------------------1----------------------   100
 26 FUNK 6   ---------------------------------------------------------------------------------1-----------------------1-------   100
 46 POPA     --------------1---1----------------------------1-1---------------1-2------1--------------------1-1-1-----------   100
 54 SALI X2  -----------------------------------------------------------------------------------------------1---------12-3-----   10100
 56 SALI X4  1--1--------------------1---1-------------------------------------11---------------------1---------------1153---   10100
 55 SALI X3  -----------------------------------------------------------------1-----------------------------11-1-222--1--343211---   101010
  9 ARLU     -------------------------------------------------------------------------------------------------1---------------   101011
 38 LAPA     ----------------------------------------------------------------------------------------------------1-----------   101011
 53 SALI X1  ------------------------------------------------1--------------------1----------------------2443421124231311132234---   101011
 58 SALI X6  -----------------------------------------------------------3-----------------------------2-333242343523--112----1-   101011
 59 SALI X7  -------------------------------------------------------------------------------------------1122132---------2---511   101011
  3 ALTE     ----11-1-----------11---1-1--1------111-11-----------1---------132------2--1---1-------1------------31222-211------   1011
 28 GUNK 1   ------1-1-----------------------1-----------1-1-1-----------------2-1---------1---------2113---------------------   1011
 32 GUNK 4   ------------12--------------------------------------------------------2-----------------------1-----1--1------   1011
 34 GUNK 6   ----------1-2----1--11--11------1-11--1-----1-------------1----------1--3-3-----------------1-21------21-----------   110
 36 GUNK 8   -----------32---111-111-11112-1--1-1---------1-----1-------------------31-----1-------------2--1---3-132------------   110
 64 SOCA     1-3-1-----112---------------------------------------------------------1-----------------1------11--1------------   110
 65 SPBE     --------------1--------------------1---------------------1-----------------------------------1---------------------   110
 11 ASMO     -1-----------1-----------1------------------------------------------------------------------------11-------------   111
 13 BRIN     ---------------2------------------------------------------------------------------------------2-----------------------   111

             000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000011111111111111111111111111
             000000000000000000000000000000000000000000000000111111111111111111111111111111111111111111110000000000000000000000111
             000000000011111111111111111111111111111111111111000000000000000000000000000000000000000000001000000000000111111111
             001111111100000000000000000000011111111111111111100000000000000000000000000000000111111111111111 0111111111110000000111
               00001111000000011111111111111000000011111111111000000000011111111111111111111110000000000000011   00001111111110001111
                         0001111000000000000001000001100000000010000111111000000000000000111111000000000011111        000)011
```

Figure 48. TWINSPAN site-by-species two-way classification table for cover data for all shrub and herbaceous species.