CHAPTER VII
ENVIRONMENT

Climate

The Lincoln Planning Area is located along the western front of the Rocky Mountains and exhibits characteristics of both the modified maritime climate typical of western Montana valleys and the more continental type climate of eastern Montana. Weather patterns are influenced by Pacific and Canadian fronts. The wind is predominately out of the northwest. Average annual precipitation recorded at the Lincoln Ranger Station is 18.57 inches. June is the wettest month, averaging 2.70 inches followed by May with 2.19 inches of precipitation. January receives the most snowfall with 23.11 inches average.

The average annual temperature is 40.1 degrees Fahrenheit. Temperatures are more mild in the winter and cooler in the summer than those experienced over the Montana plains; however, several short periods of below zero temperatures occur each winter. The infrequent occurrences of very cold air are usually caused by Arctic air over the plains becoming deep enough to spill westward across the Continental Divide. The invasions of cold air into the valley can be accompanied by strong easterly winds and blizzard conditions. Severely cold weather generally lasts only a few days (Cordell, 1970).

Mild days and cool nights with occasional thunderstorms are characteristic of summer with the daily maximum temperature being 82 degrees F. and the average minimum 41 degrees F. Oppressively hot weather is almost unknown as the highest recorded temperature is 102 degrees F. Strong night time radiation cooling causes freezing, or near freezing, temperatures during each month of the summer. There is an average of 71 days between the last occurrence of 28 degrees in the spring and the first recorded temperature of 28 degrees F. in the late summer. Thus, vegetation is limited to the more hardy varieties.

Table VII-1 summarizes 45 years of temperature, precipitation and snowfall data collected from 1949 through June 2005 at the Lincoln Ranger Station.

TABLE VII-1:
WEATHER DATA SUMMARY
1949 – JUNE 2005

	Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average High Temperature (Fahrenheit)	71.1	48.9	53.4	63.2	76.1	87.4	93.2	98.8	99.9	93.1	80.3	51.0	48.6
Average Low Temperature (Fahrenheit)	7.2	-24.1	-16.6	-7.8	12.6	23.0	30.0	34.3	31.2	21.1	12.3	-6.3	-17.2
Average Precipitation (Inches)	18.78	2.06	1.57	1.62	1.44	2.33	2.51	1.24	1.34	1.42	1.34	1.50	1.94
Average Snowfall (Inches)	90.02	22.01	15.19	13.90	7.28	1.99	0.00	0.00	0.00	0.47	2.41	10.97	18.62

(Source: Lincoln Ranger District, 2005)

Air Quality

The air quality in the Lincoln area is generally thought to be good. Air quality was done in the Lincoln Townsite, and the initial monitoring, done near the intersection of Stemple Pass Road and Highway 200 showed substantially poor air quality. The wintertime burning of firewood is the likely cause, aggravated by wood smoke being unable to dissipate due to the dense tree cover in the townsite. Air quality monitoring done later near the Parker Clinic showed very low air particulate levels.

During periods of low cloud cover in the winter months, a noticeable haze hangs over the Lincoln Townsite. Wood burning heating devices and vehicles are the main sources of emissions that contribute to the haze.

The haze does not appear to be a health concern at this time. The installation of newer and more efficient wood burning devices, such as pellet stoves, would significantly reduce the wintertime accumulation of pollutants within the Townsite.

Geology

The area of the Upper Blackfoot Valley is characterized by a thick sequence of Precambrian age sedimentary rock of the Belt Supergroup. The Precambrian rocks are disconformably overlain locally by a sequence of Eocene/Oligocene age volcanic rocks that reach a thickness of up to 2,000 feet. Late Cretaceous and early Tertiary intermediate intrusive rocks were emplaced in the Heddleston District, east of Lincoln. and also near Stemple Pass. These intrusives appear to pre-date the volcanics by approximately 5 to 10 million years (Figure 10).

The oldest volcanic rocks are predominately andesites, which were subsequently overlain by a sequence of felsic pyroclastic rocks. In turn, the felsic pyroclastic rocks are overlain by fluvial-lacustrine volcano-clastic rocks and by at least one rhyolite flow, deposited in a local tectonic basin. Uplift and tilting of the volcanic sequence to the north resulted in rapid erosion and subsequent deposition, within the basin, of boulder conglomerates and course sandstones of probable late Miocene or Pliocene age.

The Precambrian and Tertiary rocks are generally covered by unconsolidated glacial debris and alluvium. At least two glacial events have been recognized as having occurred in the area (Coffin and Wilke. 1971). During the first event, terminal moraines and outwash were deposited at least two miles to the south of the Lincoln Townsite. Ice filled the areas around what is now known as the Landers Fork and Alice Creek drainages, at least as far south as the Blackfoot Valley (Coffin and Wilke, 1971). It is possible that the ice continued westward down the Blackfoot Valley.

The second event was apparently less extensive, but still resulted in the deposition of considerable outwash deposits in the main valleys. Reworking of the outwash material has resulted in the partial filling of the Blackfoot and Landers Fork valleys with alluvium, typically sand and sandy gravel. Locally it is difficult to distinguish the original glacial outwash deposits from the reworked alluvium.

Soils

The soils in the Planning Area rest on top of and are pervaded with sorted alluvial outwash and till deposited in horizontal beds ranging from 3 inches to 30 feet in thickness. Some thin beds contain 30 to 40 percent clay and silt, and 10 to 20 percent very fine sand. Three dominant soil associations are present in the Lincoln townsite area: the Stryker Association, the Gallatin-Furniss Association, and the Swims-Bearmouth Association. Three additional soil associations typify the north and south margins of the Lincoln Valley where higher elevations phase into the mountains: the Bigel Association, the Leavitt Association, and the Loberg Association (Figure 11).

The Stryker Association comprises about 70 percent of the Lincoln Townsite area, and is typified as slowly permeable and poorly drained. The highwater, static water level is commonly within 30 inches of the surface.

The Gallatin-Furniss Association, comprising about 15 percent of the Lincoln Townsite area, has a high potential for flooding and surface ponding, is poorly drained, and exhibits slow to moderately slow permeability. Groundwater levels are commonly 36 to 60 inches below the surface.

The Swims-Bearmouth Association, comprises less than 15 percent of the area and is moderately well drained and moderately permeable. Groundwater is generally below six feet.

The Bigel Association occurs on nearly level to gently sloping gravelly alluvial fans and intermediate and high stream terraces throughout the valley. These soils are classified as well drained although the upper (8 to 15 inches), darker portions of the soil profile commonly exhibit reduced permeability.

The Leavitt Association is found on undulating to hilly glacial till uplands. Leavitt soils are commonly found between the valley terraces and the timbered uplands. Leavitt Association soils are well drained and generally display moderate to good permeability.

The Loberg Association is found on the forested hills and mountainous terrains surrounding the Blackfoot Valley. This association is commonly located between the grassland till areas and the steep bedrock mountains. Most of these soils have severe development limitations due to steepness of slope. Loberg soils are normally well drained; however, reduced permeability is common.

Figure 11 and Table VII-2 detail soil type locations and related limitations to development in most of the Lincoln Planning Area (Olson & Bingham; SCS, 1970). Soil mapping by definition is meant to be a regional planning tool. Site-specific investigations are necessary for local development information.

Slope Stability

Slope failure occurs when gravitational force of the slope materials exceeds the resisting forces due to strength, friction and cohesion of the supporting materials. Slope properties, such as steepness, layering or fracturing of materials, or lack of vegetation, can make them inherently susceptible to failure; while factors such as moisture, overloading, and undercutting, can make matters worse. These factors can occur naturally or can be induced by development activity.

Slope failures can be distinguished by five types. These include falls or free drops from steep cliffs; slides or movement of unconsolidated materials along slip surfaces of shear failure; slumps or movements of consolidated materials along the surface of shear failures; flows or the slow or rapid fluid-like movement of soils and other unconsolidated materials. very slow down-slope flow of soil is referred as creep. The average flow rate of materials can range from a fraction of an inch to 4 to 5 inches per week. Factors that influence seep include growing vegetation, freezing and thawing, and burrowing animals. Lateral spreads may occur on flat or gently sloping land due to liquefaction of underlying materials.

The hazards to development and public health and safety are obviously most prevalent in the mountainous areas that border the Blackfoot Valley. Localized hazards may occur anywhere within the planning area. It is the responsibility of those who wish to develop within the planning area to assess the degree of hazard in their selection of development sites. Generally three variables: slope, geologic materials and landslide deposits should be rated in determining the suitability of a particular site. Based upon these three variables, sites can generally be categorized as:

Stable - Areas having 0-5 percent slopes that are not underlain by unconsolidated deposits.

Unstable - Areas of 0-5 percent slope that are underlain by moist unconsolidated materials or muds. Unstable due to settlement problems.

Generally Stable - Areas of 5-15 percent slope that are not underlain by landslide or unconsolidated materials.

Generally stable to Marginally Stable - Areas of greater than 15 percent slope that are not underlain by landslide deposits or bedrock units susceptible to landsliding.

Moderately Unstable - Areas greater than 15 percent slope that are underlain by bedrock units susceptible to landsliding but not underlain by landslide deposits.

Unstable - Areas of any slope that are underlain by or immediately adjacent to landslide deposits.

Earthquakes

According to the Montana Bureau of Mines and Geology, "earthquakes have been part of life in Montana almost since the beginning of written history. The geologic history of western Montana, indicates that earthquakes accompanied the formation of the Rocky Mountains and will continue to be part of the mountainous region of western Montana" (Stickney, 1993). Because earthquakes cannot be predicted or avoided, some understanding about earthquakes and the precautions necessary to reduce potential hazards, property loss and injury are needed.

The Lincoln Planning Area is located in a zone of earthquake activity. This zone, which is shown in Figures 12 and 12.1 and is known as the Intermountain seismic belt. The zone extends from northwest Montana southward to southern Utah. Several active fault lines have been located within the zone; however, historically most earthquakes that have occurred in Montana cannot be correlated with specific faults that are visible at the surface of the earth except for earthquakes with magnitudes over 7.0. This paradox seems to hold true throughout the Intermountain seismic belt. Apparently, small to moderate magnitude earthquakes occur at depths of three (3) to ten (10) miles below the surface of the earth on small, discontinuous faults that do not extend to the earth's surface. Hidden faults like this were responsible for the damaging earthquake that occurred in Helena in 1935.

Earthquakes are measured by two variables, magnitude and intensity. The magnitude of a earthquake, as measured on the Richter scale, reflects the energy release of an earthquake. The intensity of an earthquake is gauged by the perceptions and reactions of observers as well as the types and amount of damage. The intensity of an earthquake is rated by the Modified Mercalli Scale. This scale ranks the intensity from I to XII. An earthquake rated as a I, would not be felt except by very few people under especially favorable circumstances. A intensity rating of XII on the other hand would result in total destruction. Seismic waves would be seen on the ground surface, lines of sight and level would be distorted and objects would be thrown upward into the air.

The Lincoln Planning Area, as shown in Chapter I, Figures 1 and 2, is rated as having an intensity level of VIII. Damage is predicted to be slight in buildings designed specially for the seismic zone. Buildings not constructed to meet the standards for the seismic zone would experience considerable damage with partial collapse. Panel walls would be thrown out of frame structures. There would be destruction of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture would also be overturned. Sand and mud would be ejected from the ground in small amounts. There would also be changes in the static water levels in wells.

When an earthquake occurs, energy is released by the rupturing of the earth's crust that causes cyclic waves to travel through the rock and soil mass. When this cyclic motion occurs, a phenomena referred to as liquefaction also occurs, if certain geologic and hydrogeologic conditions exist. During the liquefaction process there is a transformation of water-saturated sediments from a solid to a liquid state as a consequence of increased pore water pressure.

The first condition, which must be present for liquefaction to occur, is that the area must be located in a seismic active zone and be subject to earthquakes greater than 5.0 (Lowe 1990). Secondly, the area must located where there is a shallow depth to groundwater. A large majority of the Blackfoot Valley is underlain by groundwater at depths less than 10 feet. Also unconsolidated sediments with sand and silt must be Present before liquefaction can occur. Although extensive soils mapping of privately owned lands within the Blackfoot Valley has not been conducted, most valleys are filled with alluvial deposits that contain sand and silt. It appears, that the conditions needed to create a liquefaction hazard are present in the Blackfoot Valley.

In order to more accurately assess liquefaction susceptibility of the Blackfoot Valley, detailed data on groundwater depth and geologic materials will need to be collected. If this information is collected, the Montana Bureau of Mines and Geology (MBMG) translate the information into a digital format. The liquefaction susceptibility of the different geologic units can be determined based on the age of the deposit, the percent sand and silt in the deposit, the degree of sorting of the sediment in the deposit, and the average thickness of the geological unit.

An assessment of the age of the deposit is important in determining liquefaction susceptibility because as the age of the deposit increases it is more likely that the sediments will have been cemented together or compacted, thus less likely to liquefy. Based upon a large volume of work conducted in the Helena and similarly formed valleys, it has been determined that sediment deposited more than 750,000 years ago are considered to have very low chance of liquefaction (Obermier et al, 1990).

The percent of sand and silt in the unit is also an important geologic characteristic in determining liquefaction susceptibility. Since sand and silt are the only grain sizes known to liquefy (Tinsley et. aI., 1985). Geologic units with high sand and silt concentrations would be assigned the highest liquefaction values.

Sorting is another characteristic, which determines the sediment's susceptibility to liquefaction. The better sorted the sediment is the more likely the sediment will liquefy. (Obermieir etal., 1990).

The final geologic characteristic, which will need to be assessed, is the average thickness of the unit. The thicker the sediment is, the more likely it will amplify the shaking intensity of an earthquake (Matti and Carson, 1991). The increased shaking intensity associated with thicker sediments results in a greater chance of liquefaction occurring.

When the analysis of the liquefaction susceptibility of the geologic units is combined with the depth to groundwater data, map coverages can be produced showing the areas with the highest potentials for liquefaction to occur. Because the susceptibility categories will be based on broad generalizations concerning the geology and the hydrogeology of the area, site-specific liquefaction tests should be required for all public and commercial buildings built in areas of the highest liquefaction susceptibility (Lowe, 1991). The site-specific tests will determine if special building considerations are needed. In areas of moderate susceptibility geo-technical tests may be required to assess liquefaction potential depending upon the intended population of the building or size of structure. Areas, which are designated as having low or very low susceptibility should not be, required to conduct special geo-technical investigations prior to construction.

Hydrology

The hydrology of the Lincoln valley is dominated by the Blackfoot River and its tributaries. The Blackfoot River originates at the confluence of Beartrap and Anaconda Creeks approximately 18.5 miles upgradient from Lincoln. From the headwaters, the river flows westward through a predominantly forested valley

124 miles to its confluence with the Clarks Fork River at Bonner, Montana. Stream flows are small in the headwaters, generally averaging less than 20 cubic feet per second (cfs), but increase by several orders of magnitude as the river is joined by numerous tributary streams. The total Blackfoot drainage basin covers 2,320 square miles. Annual average discharge near Bonner is 1,633 cfs (Figure 13).

Topography and geology of the upper Blackfoot River and several of its tributaries were strongly influenced by glacial activity. Glacial ice invaded the valley from the north at least twice (Coffin and Wilke, 1971). This ice deposited both extensive outwash deposits and moraine drifts. Lobes of glaciers occupied Alice Creek and Landers Fork in addition to other smaller drainages in the area (Alder, 1953). The locations and extent of these glacial deposits strongly influence stream flows in local reaches of the main Blackfoot and some of its tributaries. Valley-fill deposits 300 feet or more thick are found in the reach of the Blackfoot from 10 miles above to two miles below Lincoln. The river loses considerable water to the underlying aquifer in this reach, but generally gains water in the down gradient reaches below the Blackfoot Canyon west of Lincoln. Water losses to the groundwater causes depletion of surface water flows in portions of the Blackfoot and Landers Fork to the point where they are routinely dry over certain reaches for portions of the year.

The Blackfoot River is rated Class I in the Montana Department of Fish, Wildlife and Parks (DFWP) statewide rating system because of its high ratings in categories of fish production, fish habitat, fish species present, aesthetics, and public access. It is one of two streams in western Montana on which the DFWP has an in-stream water right to protect fisheries (Workman, 1987).

With respect to water quality, the Blackfoot River and its tributaries are classified as B-1 in the Montana water quality standards. This classification specifies that such waters be maintained as suitable for drinking, culinary and food processing purposes (after adequate treatment as necessary to remove impurities); bathing, swimming, and recreation; growth and propagation of salmonid fish and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Water quality in the Blackfoot River and its tributaries varies widely but is generally considered to be good and suitable for its designated beneficial uses. Many of the Blackfoot's tributaries, which enter from the north, originate in remote mountainous regions, which are largely uninfluenced by human activities. However, several tributaries, including Landers Fork, carry high sediment loads during runoff periods that have increased since the severe fires of 1988. Tributaries that enter from the south and several in the headwaters area exhibit more impact from human activity including mining, logging, and agricultural practices (MDHES, 1975, 1986).

Acute, mining-related impacts on water quality are evident in the upper Blackfoot system. The largest contributor of low pH, high metal effluent (zinc, copper and silver) is the Mike Horse Mine adit that operated sporadically through the early 1950's. In 1975, heavy runoff and the failure of the Mike Horse Dam resulted in the release of approximately 100,000 tons of material into the headwaters of the Blackfoot (Dames and Moore, 1975). As a result of those impacts, the Upper Blackfoot Mining Complex was placed on the State Superfund list (CECRA) in 1991. In 1992, Asarco and Arco, the responsible parties for the site, negotiated a voluntary clean-up agreement with MDHES wherein the remedial investigation feasibility studies would be suspended and clean-up would begin. The Lincoln Community Council endorsed that agreement.

In 1993 14,000 cubic yards of mine waste and tailings was removed from the Lower Carbonate Mine area, the wastes were limed and placed in a repository at the Upper carbonate Mine. In 1993 and 1994, a stream diversion along the Mike Horse Creek and the Mike Horse Mine treatability pond were constructed, which included installation of the pond liner and construction of a spillway. Excavation and removal of hydrocarbon-contaminated soil at the Mike Horse Mine was completed in 1994. Approximately 7,300 cubic yard of waste material was removed from the Lower Anaconda Mine area and relocated to the Mike Horse Mine repository site.. New monitoring wells were installed at the Anaconda, Carbonate and Mike Horse Mine sites.

Between 1995 and 1997 remediation activities continued including: removal of mine waste and tailings from the Lower Anaconda and Edith mines, revegetation of the Edith Mine area, completion of the Mike Horse repository and treatability pond, construction of wetland treatment cells at the Anaconda Mine site, installation of a pipeline from the treatability pond to the wetland treatment cells, removal of waste materials and reclamation of waste piles at several mine sites, revegetation of the Upper Mike Horse Mine area and remediation of the Tunnel #3, capitol and Constellation mine area.

In 1999, ASARCO petitioned the Montana Board of Environmental Review for temporary water quality standards for segments of Mike Horse and Beartrap creeks and a portion of the Upper Blackfoot River, and were granted temporary standards for a period of 10 years in 2000.

The Mike Horse Dam is located on Forest Service land, and the Forest Service is responsible for its upkeep. In 2005, the Forest Service completed a peer-reviewed report that found that the dam was a "compromised structure" eroding away from within and should be removed from service. As of September 2005, the Forest Service is studying action plans to deal with the problems at the Mike Horse Dam.

The Blackfoot River Basin is a sub-basin of the Upper Clark's Fork River Basin. Table VII-3 lists the classification of perennial streams and rivers, within the Lincoln Planning Area. The classifications are based on a tributary system with

some modifications, based on relative size and drainage area. Figure 13 shows the locations of the major streams in the Planning Area.

The Blackfoot River and its tributaries have many uses and benefits, including irrigation, recreation, aesthetics, fisheries habitat, wildlife habitat and the production of hydroelectric power at the Northwestern Energy Company generating plant in Milltown. The Milltown hydroelectric facility is one of the oldest in the Clark Fork Basin. The Milltown generating station established its priority water rights in 1904 and today uses up to 1,451,556 acre-feet per year to generate 3.4 megawatts of electricity. At times, half the water flowing through the facility is from the Blackfoot River (Upper Clark Fork Water News, June, 1994). Due to structural problems and the buildup of contaminated sediments piled up behind it, the Milltown Dam is slated for removal. The dam is scheduled to be removed from the river as early as the winter of 2007 with a two-year sediment excavation project to follow.

TABLE VII-3
STREAM CLASSIFICATION

TYPE I	TYPE II	TYPE III
Big Blackfoot River	Poorman Creek	
	Beaver Creek	
	Stonewall Creek	
	Keep Cool Creek	Sucker Creek
	Humbug Creek	
	Seven-Up Pete Creek	
	Landers Fork	Copper Creek
		Snowbank Creek
	Falls Creek	
	Ringeye Creek	
	Middle Fork Creek	
	Hogum Creek	
	Willow Creek	
	Alice Creek	Bartlett Creek
	Shuve Creek	
	Anaconda Creek	
	North Fork Blackfoot	Dry Fork, Blackfoot
		Cabin Creek
		Canyon Creek
		E Fork, Blackfoot
		Cooney Creek
		Dabrota Creek

(Source: The Dept. of Health & Environmental Sciences, Water Quality Bureau)

The Lewis and Clark County Subdivision Regulations establish waterbody setbacks and buffer areas throughout the county. The water body setbacks and buffer area requirements are in Chapter XI.W of the County Subdivision Regulations. Classifications of waterbodies are differentiated by types of waterbodies and are in Appendix O of the County Subdivision Regulations. The waterbody setback and buffer areas for the Blackfoot River area 250 feet and 100 feet, respectively. Tributaries of the Blackfoot River have setbacks and buffers of 200 and 75 feet (Type II) and 100 and 50 feet (Type III), respectively.

The complexity of maintaining habitats in order to sustain plant and animal populations, particularly fisheries habitat, is a challenging issue. Not only are the physical and chemical characteristics of the surface water important, but also land use practices adjacent to the streams are essential. Land-use practices that are good for maintaining soils, terrestrial vegetation, and steam channel stability are good for the fishery populations. On Montana's steams, good habitat is cool, clean, clear water flowing through deep pools, steep riffles and log jams. Good stream habitat includes overhanging trees, and bushes, as well as undercut banks.

Water quantity is critical to fisheries habitat. Water quantity controls the space available for fish and also controls food production. Water quality is also an important aspect of habitat. Many fish species have very narrow water temperature ranges in which they can live and reproduce. Water temperature also affects the amount of dissolved oxygen that water can hold. The colder the water the more dissolved oxygen it can hold. Water also needs to be free from sediments, chemicals and other substances. Sediments destroy the gravelly areas needed for fishery reproduction (Workman, 1994).

Balancing the beneficial and sometime competing water uses along the Blackfoot and the rest of the Upper Clark Fork River Basin has become an issue over the years. To address the use issues the Montana Legislature authorized the creation of the Upper Clark Fork River Basin Committee to draft a comprehensive water management plan. To date the committee has recommended:

1) Closing the Clark Fork drainage to new surface and some groundwater rights (includes the Planning Area). The restrictions would be statutory and would be reviewed every five years.

2) Holding the existing water reservations in abeyance. This would also be reviewed every five years.

3) Creation of ongoing river basin and watershed committees to focus on local water quality, quantity and management (McLane, 1994).

Development activities in or near streams are governed by the Montana Stream Protection Act (124 permit) and the Montana Natural Streambed and Land Preservation Act (310 permit). A 124 permit is required of all governmental agencies proposing projects that may affect the beds or banks of any stream in Montana. The purpose of the law is to preserve and protect fish and wildlife resources in their natural existing state. The Montana Department of Fish, Wildlife and Parks administers this law. A 310 permit is required of all private, non-governmental individuals or corporations that propose to work in or near a stream. The purpose of the law is to minimize soil erosion and sedimentation, maintain water quality and stream channel integrity and prevent property damage to adjacent landowners. The Lewis & Clark County Conservation District, of the Department of Natural Resources and Conservation administers this permit.

Groundwater

All residents and businesses within the Lincoln Planning Area rely upon groundwater for their potable water. Generally each resident or business has their own water well. Within the valley portions of the planning area, water for potable use is drawn from a very shallow, unconfined alluvial aquifer. The shallow depths to groundwater makes the water supply very susceptible to contamination. The shallow depth to ground water was the main factor in the installation of the Lincoln Sewer System.

The capacity of the shallow aquifer to accept contaminants before it is measurably degraded is unknown. More knowledge of the aquifer system and its dilution capacity is needed to determine development densities.

Since 1983, several sites within the Lincoln Townsite have been identified as sources of petroleum contamination. These areas are concentrated at the intersection of Highway 200 and Stemple Pass Road. In conjunction with Montana State agencies corrective actions were undertaken.

Stormwater

Lincoln does not have a formal stormwater plan at the current time. As the population grows and commercial development expands, a stormwater plan is becoming an increasingly important issue. Currently, stormwater runoff is a problem along Highway 200 through the Lincoln townsite. This area is predominantly commercial and as more businesses pave their parking areas the problem is exacerbated. Lincoln School has a serious stormwater problem developing. Snow runoff and heavy rains flood the northwest comer of the school yard to depths of several feet. Recently, the Fire Department has had to rig up pumps and hoses to divert the water to Lambkin Park, north of the school.

Lincoln's stormwater problem is caused by a combination of factors; the lack of topographic relief causes ponding; Highway 200 construction has disrupted drainage patterns and has increased in elevation due to periodic resurfacing; and more businesses are paving their parking areas adjacent to the Highway.
The Lincoln Community Council, the Lewis and Clark County Commissioners and the Montana Department of Transportation need to investigate possible avenues to not only manage stormwater runoff but funding mechanisms to finance the stormwater management infrastructure.

The Lincoln Road Improvement District (RID) was created in 2004 for the purpose of funding improvements to the streets in the Lincoln Townsite, excluding Highway 200. The improvements include asphalt overlay, pothole repair, blade patching, chip sealing, shaping and compacting of gravel, and gravel replacement. The work associated with the road improvements may alleviate some of the drainage problems.

Floodplain

Flooding along the Blackfoot River and its tributaries is historically a common event. Major flooding has occurred along the Blackfoot in 1908,1964, and 1975. Flooding has usually been caused by heavy rainfall combined with snowmelt.

Records indicate that the 1964 flood was less than a 100-year event. During the substantial flooding in 1975, the discharge for the Blackfoot River at Lincoln was 7,370 cubic feet per second (cfs). Figure 14 shows the FEMA designated floodplain around the Townsite.

Flood events are commonly termed as 10, 50,100 and 500 year events (re-occurrence interval) and have a 10, 2, 1 and 0.2 percent chance, respectively, of being equaled or exceeded during any year. The re-occurrence interval represents the long-term average period between floods of a specific magnitude. Rare floods can and do occur at shorter intervals. Rare flood events can occur several times within the same year. The risk of experiencing a rare flood increases when periods greater than one (1) year are considered. For example, the risk of having floods, which equal or exceed the 100-year flood (1% chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10) (FEMA, 1984).

In 1981, the Federal Emergency Management Agency (FEMA) prepared detailed floodplain maps for portion of the Blackfoot River. The area delineated extends from a point approximately 2 miles downstream from the Lincoln Townsite for approximately 11 miles upstream to above the confluence of the Landers Fork. Additional floodplain delineation studies were conducted on portions of the Landers Fork and segments of the Blackfoot River east of the Landers Fork to approximately the Bouma Postyard. The floodplain consists of areas along the water courses that would be covered by floodwater in a base flood, including sheet flood areas that receive less than one (1) foot of water per occurrence, and are considered Zone B by FEMA. The floodplain consists of a floodway and a floodway fringe.

The floodway is the channel of a stream and the adjacent overbank areas that must be reserved in order to discharge a base flood without cumulatively increasing the water surface elevation more than six (6) inches. These areas are shown on FEMA maps as Zone A. Development of permanent structures, such as homes and businesses, are prohibited. Placement of fill or culverts, excavation, storage of equipment or materials, and construction of bridges require a Floodplain Development Permit. This permit may be issued by the Lewis and Clark County Floodplain Coordinator.

The floodway fringe is the area of the floodplain outside the limits of floodway. These areas are referred to as Zone B on FEMA maps. Construction of permanent structures are possible within Zone B, but only after the issuance of a Floodplain Development Permit. The permit may require flood proofing of the structure and other mitigation measures.

Wetlands

The United States Fish and Wildlife Service (USFWS) defines wetlands as: "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For the purposes of definition, wetlands must have one or all of the following three attributes:

1. At least periodically, the land supports predominately hydrophytes;

2. The substrate is predominately undrained hydric soils; and

3. The substrate is nonsoil and is saturated with water or covered by shallow water during the growing season each year;

The USFWS's classification system groups wetlands into five ecological systems according to ecological characteristics. Three of these types of wetlands groups, Riverine, Lacustrine, and Palustrine are found within the Lincoln Planning Area. The Riverine system is limited to freshwater river and stream channels. It is mainly freshwater, deepwater habitat system but has nonpersistent marshes and aquatic beds along its banks. The Lacustrine system is also deepwater habitat system that includes standing water bodies like lakes and deep ponds. The Palustrine system encompasses the vast majority of the nontidal wetlands, such as swamps and bogs.

Palustrine wetlands found in the Lincoln Planning area are of three major types: emergent wetland; scrub-shrub wetland, and forested wetland. Emergent wetlands are dominated by non-woody vegetation, including certain grasses, cattails, rushes and sedges. Emergent wetlands may be flooded for variable periods from as little as a couple of weeks in the early growing season to being

permanently flooded. These wetlands may be found along the margins of rivers and lakes, in isolated depressions or in seepage areas on gentle slopes.

Scrub-shrub wetlands are not as common as emergent wetlands and are dominated by woody vegetation less than 20 feet tall. These wetlands are seldom flooded and are generally characterized by saturated soil with water table at or near the surface for most of the year. These wetlands normally occur in isolated depressions along river courses.

Vegetation on forested wetlands is dominated by trees such as Western hemlock, red alder, willows, cottonwoods and green ash.

Wetlands provide economic benefit, improves water quality" and supports wildlife and fish. The most noticeable benefit of wetlands include flood and storm water damage protection, erosion control, water supply, groundwater recharge, and recreation.

Wetlands play a major in the quality of the natural environment, they are however, subject to both human and natural forces which may result in their degradation or loss. The major causes of wetland loss and degradation include:

1) drainage for crop production, timber production and vector control;

2) filling for dredged spoil and other solid waste, road construction, and residential, commercial and industrial development;

3) construction of flood control, water supply, irrigation and storm water protection structures;

4) discharges of pesticides and other pollutants, nutrient loading from sewage and agricultural runoff;

5) sedimentation from agricultural and development activity;

6) erosion and accretion; and

7) mining of wetlands for sand, gravel and other materials.

The primary federal regulatory program covering wetlands is Section 404 of the Clean Water Act.. This program regulates discharges of dredge and fill materials into the waters of the United States, including most wetlands. The Section 404 program is administered jointly by the US Army Corp of Engineers and the Environmental Protection Agency (EPA). The US Fish and Wildlife Service is given an advisory and commenting role in the 404 process. The Montana Department of Fish, Wildlife and Parks and the Department of Environmental Quality, Water Quality Bureau are the lead State agencies dealing with wetlands.

Vegetation

Most of the Lincoln Planning area is dominantly coniferous forest, with areas of mountain grassland and shrubland scattered throughout. Ponderosa pine, Douglas-fir and lodgepole pine are important tree species. Subalpine fir, Whitebark pine, Limber pine and Engelmann spruce are locally important. Rough fescue, Idaho fescue, bluebunch wheatgrass and big sagebrush are the dominant species in the mountain grassland and shrubland. Grasslands and shrublands at lower elevations contain plant species from the adjacent intermountain basins. Patterns of plant communities reflect the occurrences of periodic wildfires.

Habitat types are considered to be the basic ecological subdivision of landscapes. Each is recognized by distinctive combinations of over story and understory plants at climax growth. Each habitat type group is named for the dominant characteristic vegetation.

Habitat types are particularly useful in soil surveys of mountainous area for assessing the combined effects of aspect, slope, elevation and soil properties on potential vegetation growth. The distribution of habitat types are important in evaluating potential timber and forage productivity, limitations to forest regeneration, and wildlife habitat potential. Brief descriptions of the major habitat types found in the planning area are listed below.

Lower mixed forest habitat type group is moderately extensive on low elevation mountain slopes, rolling uplands and southerly aspect breaklands. Elevation is mainly 3,500 to 5,000 feet with elevations up to 7,000 feet on steep southerly aspect. slopes. This habitat type contains forest stands, which are mainly ponderosa pine or mixed Douglas-fir and ponderosa pine. Major habitat types are ponderosa pine/Idaho fescue, Douglas-fir/snowberry, Douglas-fir/Idaho fescue, Douglas fir/rough fescue, and Douglas-fir/pinegrass, kinnikinnick phase. Ponderosa pine/bluebunch wheatgrass and ponderosa pine/bitterbrush are less extensive.

Upper mixed forest habitat group type is extensively at 4,200 to 7,000 feet elevation with elevations up to 7,500 feet on the southerly aspects and as low as 3,800 feet on steep northerly aspects. This habitat group type is commonly associated with soils underlain by limestone bedrock at elevations of 6,000 to 7,500 feet. This habitat type contains forest stands, which are mainly above the cold limits of ponderosa pine, but are not too cold to support Douglas-fir.

Lower subalpine forest habitat group type is extensively at 6,000 to 7,200 feet elevation. It is associated with moderately acid to neutral soils and is not found on neutral to moderately alkaline soils underlain by limestone. Forest stands are mainly lodgepole pine. Douglas-fir is not common, although it is sometimes present on southerly aspect or lower elevation stands. Engelmann spruce and subalpine firs are sometimes dominant in old growth stands.

Upper subalpine forest habitat type group is of a minor extent on mountain ridges or in glacial valleys. It is mainly found at elevations of 7,200 to 9,000 feet, but may be found at elevations as low as 6,000 feet on wind swept ridges. The forest stands are mainly mixed whitebark and lodgepole pine. Engelmann spruce and subalpine fir are sometimes dominant in old growth stands. Limber pine is sometimes present on soils underlain by limestone or on windswept ridges.

Wet forest habitat types group is found to a minor extent on stream flood plains, terraces and glacial moraines at elevations of 4,000 to 7,000 feet. This habitat group type is found in soils with fluctuating water tables. Forest stands are often dominated by Engelmann spruce, but can contain subalpine fir and lodgepole pine.

Mountain grassland and shrubland are found at elevations of 4,000 to 7,500 feet. Dominant plant species found in this habitat type include: rough fescue, Idaho fescue and big sagebrush.

Alpine meadows are found on mountain ridges at elevations of 8,000 to 9,500 feet. These forb-rich grasslands are usually found above the timberline. Dominant grasses or grass-like plants include: tufted hairgrass, Idaho fescue, rough fescue and sedges.

Wet shrubland and meadows habitat types and community types are found on soils with fluctuating water tables. Vegetation is predominately sedge grassland or willow, Sitka alder or bog birch. Tufted hairgrass and *Carex Spp.* are the major habitat types in wet meadows. Willow, Sitka alder or bog birch community types dominate wet shrublands.

Rare. Threatened. or Sensitive Plant Species

The Montana Natural Heritage Program identified eight (8) plant species and three (3) plant associations that are considered to be rare or vulnerable to extinction within the range in the Lincoln Planning Area. Table VII-4 provides the common names of the species and their current status.

TABLE VII-4
RARE, THREATENED AND SENSITIVE PLANT SPECIES

Species of Concern	Status
Cliff Toothwort	State-rare in area, vulnerable to extinction throughout range
Dense-leaf Whitlow-Grass	State-very rare in area, vulnerable to extinction throughout range
Divide Bladderwort	State-rare in area, vulnerable to extinction throughout range
English Sundew	State-very rare in area, vulnerable to extinction throughout range
Linear-Leaved Sundew	Forest Service-sensitive, State-officially imperiled
Missoula Phlox	Forest Service-sensitive, State imperiled due to rarity
Pale Sedge	Forest Service-sensitive, State imperiled due to rarity
Water Bulrush	Forest Service-sensitive, State-officially imperiled
Mud Sedge Association	State-rare in area, vulnerable to extinction throughout range
Northern Mannagrass Association	State-rare in area, vulnerable to extinction throughout range
Spruce/Field Horsetail Association	State-rare in area, vulnerable to extinction throughout range

(Source: Montana Natural Heritage Program, 1994)

Noxious Weeds

Noxious weeds have infested Lewis and Clark County and the rest of Montana.

Until recently noxious weeds have been perceived as an agricultural concern.

But as more development occurs and more people are taking advantage of Montana's outdoor recreational opportunities, the noxious weed problem is becoming more widespread, more costly to mitigate and is resulting in the degradation and loss of wildlife habitat and species diversity, decreases in property values, decreases in agricultural productivity and possibly water quality degradation.

The Montana Department of Agriculture defines a noxious weed as "any non-native plant that is harmful to agriculture, wildlife, forestry, recreation and other beneficial use of the land. Currently, the Department has declared 15 weeds as noxious. These weeds are grouped and categorized according to their abundance throughout the state. These weeds are identified in Table VII-5.

In 1985, the Montana Legislature passed a County Noxious Weed Control Act. This Act gives the counties authority to more aggressively fight local weed infestation problems. The Act requires anyone seeking a permit to disturb land from a public agency to file a revegetation plan. The revegetation plan must be approved by the Soil Conservation District. If weeds are identified as being present, a five-year weed management plan must be filed The Lewis and Clark Weed District and the plan approved by the Weed Board. The County applies a portion of the County property tax levies to weed control.

Because funding is limited, the Lewis and Clark County Weed District and other state agencies responsible for weed management have established a set of

priorities to efficiently spend these limited funds. These priorities include funding weed management projects that will:

1. preserve the most biologically intact areas;

2. preserve those areas with the highest proportion of native species;

3. preserve those areas that contain threatened, rare, or endangered plant species;

4. control weeds that are localized and therefore more readily eradicated with relatively small expense;

5. control weeds in areas such as public right-of-ways, accesses and other areas where the public-at-large can inadvertently pick up noxious weeds and spread them; and

6. control weeds in areas where they are having adverse impacts on the ecosystem, such as critical wildlife habitat and domestic grazing areas.

TABLE VII-5:
MONTANA NOXIOUS WEEDS

Species	Category
Cardaria draba (whitetop)	1
Cardaria spp. (Cardaria complex (combined))	1
Centaurea diffusa (diffuse knapweed)	1
Centaurea maculosa (spotted knapweed)	1
Centaurea repens (Russian knapweed)	1
Centaurea solstitialis (yellow starthistle)	3
Chondrilla juncea (rush skeletonweed)	3
Chrysanthemum leucanthemum (oxeye daisy)	1
Cirsium arvense (Canada thistle)	1
Convolvulus arvensis (field bindweed)	1
Crupina vulgaris (common crupina)	3
Cynoglossum officinale (houndstongue)	1
Euphorbia esula (leafy spurge)	1
Hieracium aurantiacum (orange hawkweed)	2
Hieracium floribundum (meadow hawkweed)	2
Hieracium piloselloides (meadow hawkweed)	2
Hieracium pratense (meadow hawkweed)	2
Hypericum perforatum (St. Johnswort)	1
Iris pseudacorus (yellowflag iris)	3
Isatis tinctoria (Dyer's woad)	2
Lepidium latifolium (perennial pepperweed)	2
Linaria dalmatica (Dalmatian toadflax)	1
Linaria vulgaris (yellow toadflax)	1
Lythrum spp. (purple loosestrife) Note: Lythrum salicaria, L. virgatum, and any hybrid crosses thereof	2
Lythrum virgatum (wandlike loosestrife)	2
Myriophyllum spicatum (Eurasian watermilfoil)	3
Potentilla recta (sulfur cinquefoil)	1
Ranunculus acris (tall buttercup)	2
Senecio jacobaea (tansy ragwort)	2
Tamarix spp. (Tamarix complex (combined))	2
Tanacetum vulgare (common tansy)	1

(Source: MSU Extension Office, 2005)

Currently used methods of noxious weed control, namely chemical and cultural, are not useful in some situations. Many weed infestations occur in areas inaccessible to control equipment. Environmental constraints such as shallow depth to ground waste and the presence of surface water, as found in many areas of the Lincoln Planning District, limit the use of herbicides. In addition the cost of some herbicides application are prohibitive for use on rangelands, forest and other areas of low economic return. Because of these reasons the State of Montana, in conjunction with several Universities are attempting to establish "biological control or biocontrol" of noxious weeds. Biological controls are defined as "the planned use of living organisms to reduce the vigor, reproductive capacity, density, or the effect of the noxious weeds." Under this definition, various approaches are being considered.

They include:

1) the introduction of insects;

2) the augmentation of native bio-control agents (fungus, rusts, diseases, etc);

3) use of grazing systems in which livestock graze the noxious weeds; and the use of competing vegetation.

The main goal of biocontrol programs is to establish weed-attacking insects and pathogens so that native plant communities can begin to compete with non-native noxious species of weeds. Weeds in biocontrol areas are reduced to a level where they become part of the plant community and not a threat to it. (Petroff, 1993)

Several of these biocontrols measures are currently being utilized in various areas of the County. Additional information on the availability and cost of the these types of measure are available from the County Extension Agent and the Weed District.

Individual residential property owners may help combat the spread of noxious weeds by immediate revegetation of disturbed areas, annual application of approved herbicides in non-riparian areas in the spring of the year and manual removal of weeds before the infestation becomes severe.

Wildlife

The Blackfoot River Valley and the surrounding areas provide abundant and varied habitat for a large number of wildlife species. According the Montana Natural Heritage Program approximately 14 species of fish, 4 species of amphibians, 230 species of birds, and 50 species of mammals utilize the Planning Area for permanent or migratory habitat. Of the species found in the area. the US Fish and Wildlife Service and the U.S. Forest Service have identified the species listed in Table VII-6 as being threatened. endangered or sensitive species.

TABLE VII-6
THREATENED, ENDANGERED and SENSITIVE SPECIES

SPECIES	STATUS
Westslope Cutthroat Trout	Sensitive
Common Loon	Sensitive
Trumpeter Swan	Sensitive
Harlequin Duck	Sensitive
Bald Eagle	Threatened
Peregrine Falcon	Endangered
Least Tern	Endangered
Mountain Plover	Sensitive
Flammulated Owl	Sensitive
Black-Backed Woodpecker	Sensitive
Gray Wolf	Threatened
Wolverine	Sensitive
Lynx	Threatened
Grizzly Bear	Threatened

(Source: Montana Natural Heritage Program, 2005)