civilian and military institutions, public and private golf courses, and other nonindustrial commercial facilities.

3. Industrial and Mining:

Industrial water uses, estimated to be 8 percent of total freshwater use for all off stream categories, include cooling in factories and washing and rinsing in manufacturing processes. Some of the major water-use industries include mining, steel, paper and associated products, and chemicals and associated products. Water for both industrial and mining uses comes from public supplies, surface sources, and ground water.

4. Agricultural:

Agricultural water use can be divided between irrigation and livestock. Irrigation includes all water applied to farm or horticultural crops; livestock incorporates water used for livestock, dairies, feedlots, fish farms, and other farm needs.

5. Thermoelectric Power Generation:

This final category includes water used for the production of energy from fossil fuels, nuclear energy, or geothermal energy. Most water withdrawn for thermoelectric power production is used for condenser and reactor cooling. More than 99 percent of the water used for thermoelectric power production comes from self-supplied surface water, less than 0.2 percent from public supplies.

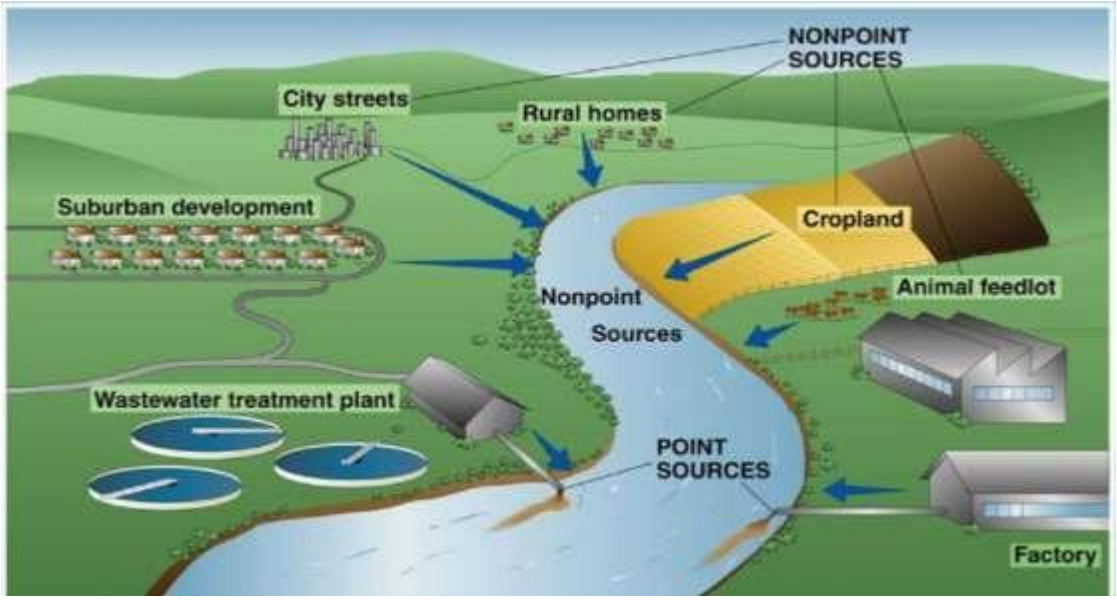
3.4 Sources of Water Pollution:

There are two main sources of water pollution: point sources and non-point sources.

(1) When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into a water body it represents **Point Source pollution. Point Sources** include factories, wastewater treatment facilities, septic systems, and other sources that are clearly discharging pollutants into water sources.

(2) Non-Point Sources are more difficult to identify, because they cannot be traced back to a

particular location. Non-point sources include discharge of pollutants from diffused sources or from a larger area such as run off from agricultural fields, grazing lands, construction sites, abandoned mines and pits, roads and streets, sediment, fertilizer, chemicals and animal wastes from farms, construction sites and mines. Landfills can also be a non-point source of pollution, if substances leach from the landfill into water supplies.



3.5 The United States Environmental Protection Agency (EPA) divides water pollution into the following six categories:

1. **Biodegradable waste consists mainly of human and animal waste**. When biodegradable waste enters a water supply, the waste provides an energy source (organic carbon) for bacteria. Organic carbon is converted to carbon dioxide and water, which can cause atmospheric pollution and acid rain; this form of pollution is far more widespread and problematic than other forms of pollutants, such as radioactive waste. If there is a large supply of organic matter in the water, oxygen-consuming (aerobic) bacteria multiply quickly, consume all available oxygen, and kill all aquatic life.

2. **Plant nutrients**, such as phosphates and nitrates, enter the water through sewage, and livestock and fertilizer runoff. Phosphates and nitrates are also found in industrial

wastes. Though these chemicals are natural, 80 percent of nitrates and 75 percent of phosphates in water are human-added. When there is too much nitrogen or phosphorus in a water supply (0.3 parts per million for nitrogen and 0.01 parts per million for phosphorus), algae begin to develop. When algae blooms, the water can turn green and cloudy, feel slimy, and smell bad. Weeds start to grow and bacteria spread. Decomposing plants use up the oxygen in the water, disrupting the aquatic life, reducing biodiversity, and even killing aquatic life.

This process, called **eutrophication**, is a natural process, but generally occurs over thousands of years. Eutrophication allows a lake to age and become more nutrient-rich; without nutrient pollution.

3. **Heat can be a source of pollution in water.** As the water temperature increases, the amount of dissolved oxygen decreases. Thermal pollution can be natural, in the case of hot springs and shallow ponds in the summertime, or human-made, through the discharge of water that has been used to cool power plants or other industrial equipment. Fish and plants require certain temperatures and oxygen levels to survive, so thermal pollution often reduces the aquatic life diversity in the water.

4. **Sediment is one of the most common sources of water pollution.** Sediment consists of mineral or organic solid matter that is washed or blown from land into water sources. Sediment pollution is difficult to identify, because it comes from non-point sources, such as construction, agricultural and livestock operations, logging, flooding, and city runoff. Sediment can cause large problems, as it can clog municipal water systems, smother aquatic life, and cause water to become increasingly turbid. And, turbid water can cause thermal pollution, because cloudy water absorbs more solar radiation.
5. **Hazardous and toxic chemicals** are usually human-made materials that are not used or disposed of properly. Point sources of chemical pollution include industrial discharges and oil spills. The Oil Pollution fact sheet includes more detailed information about oil spills, as well as other sources of oil pollution. Non-point sources of chemical pollution include runoff from paved roads and pesticide runoff. Many people think industries produce the greatest amount of chemical pollution. But domestic and personal use of chemicals can significantly contribute to chemical pollution. Household cleaners, dyes, paints and solvents are also toxic, and can accumulate when poured down drains or flushed down the toilet.

6. **Radioactive pollutants** include wastewater discharges from factories, hospitals and uranium mines. These pollutants can also come from natural isotopes, such as radon and Uranium which is highly toxic chemical. The nuclear waste that is produced by radioactive material needs to be disposed off to prevent any nuclear accident. Nuclear waste can have serious environmental hazards if not disposed off properly. Radioactive pollutants can be dangerous, and it takes many years until radioactive substances are no longer considered dangerous.

7. **Other Pollutants:**
   - **Mining activities:** Mining is the process of crushing the rock and extracting coal and other minerals from underground. These elements when extracted in the raw form contains harmful chemicals and can increase the amount of toxic elements when mixed up with water which may result in health problems. Mining activities emit several metal wastes and sulphides from the rocks and is harmful for the water.Water-pollution problems caused by mining include acid mine drainage, metal contamination, and increased sediment levels in streams. Sources can include active or abandoned surface and underground mines, processing plants, waste-disposal areas, haulage roads, or **tailings** ponds.
   - **Accidental Oil leakage:** Oil spill pose a huge concern as large amount of oil enters into the sea and does not dissolve with water; there by opens problem for local marine wildlife such as fish, birds and sea otters. For e.g.: a ship carrying large quantity of oil may spill oil if met with an accident and can cause varying damage to species in the ocean depending on the quantity of oil spill, size of ocean, toxicity of pollutant.
   - **Underground storage leakage:** Transportation of coal and other petroleum products through underground pipes is well known. Accidentals leakage may happen anytime and may cause damage to environment and result in soil erosion.

3.6 Effect of industrial activity and energy production on the water pollution

The water after it is used once for industrial purpose cannot be reused for the same purpose without treatment. Such water which emerges out after use from industries is called as the industrial effluents. Industrial activities are a significant and growing cause of poor water quality. Industry and energy production use accounts for nearly 20 percent of total global

water withdrawals, and this water is typically returned to its source in a degraded condition. Industrial wastewater can contain a number of different pollutants, including:

1. Microbiological contaminants like bacteria, viruses, and protozoa.
2. Chemicals from industrial activities like solvents and organic and inorganic pesticides, polychlorinated biphenyls (PCBs), asbestos.
3. Metals such as lead, mercury, zinc, copper, and many others.
4. Nutrients such as phosphorus and nitrogen.
5. Suspended matter including particulates and sediments.
6. Temperature changes through the discharge of warm cooling-water effluent.
7. Pharmaceuticals and personal care products.

The production of energy also has significant effects on water quality mostly because of the vast quantities of water required for power-plant cooling and the extensive risk of contamination during the search for and production of fossil fuels. There are three major effects of concern:

1. The production of vast quantities of contaminated groundwater during the drilling of oil and gas wells.
2. The withdrawal of water for power plant cooling that reduces water available for ecosystems; and
3. The heating and subsequent discharge of cooling water, which raises the ambient water temperature in rivers, streams, and lakes, with effects on natural ecosystems.