because they prevent runon of uncontaminated discharges from contacting exposed materials and/or reduce the flow across disturbed areas, thereby lessening the potential for erosion. Second, diversion structures can be used to collect or divert waters for later treatment, if necessary. The usefulness of these control measures are limited by such factors as the size of the area to be controlled and the type and nature of materials exposed and precipitation events.

Diversion dikes, curbs, and berms are temporary or permanent diversion structures that prevent runoff from passing beyond a certain point, and divert runoff away from its intended path. Dikes, curbs or berms may be used to surround and isolate areas of concern, diverting flow around piles of overburden, waste rock, and storage areas, to minimize discharge contact with contaminated materials and to limit discharges of contaminated water from confined areas.

b. Drainage/Storm Water Conveyance Systems. Drainage or storm water conveyance systems can provide either a temporary or a permanent management practice which functions to channel water away from eroded or unstabilized areas, convey runoff without causing erosion, and/or carry discharges to more stabilized areas. The use of drainage systems as a permanent measure may be most appropriate in areas with extreme slopes, areas subject to high velocity runoff, and other areas where the establishment of substantial vegetation is infeasible or impractical. For instance, several BMPs described below may be useful storm water and erosion control methods applicable to haul roads and access roads.

Channels or Gutters—Channels or gutters collect storm water runoff and direct its flow. Like diversion systems, channels or gutters may act to divert runoff away from a potential source of contamination, but may also be used to channel runoff to a collection and/or treatment area including settling ponds, basins or work-out pits.

Open Top Box Culverts, and Waterbars—These structures are temporary or permanent structures that divert water from a roadway surface. Open top box culverts may be used on steeply graded, unpaved roads in place of pipe culverts to divert surface runoff and flow from inside ditches onto the downhill slope of a road. These structures are typically made of wood and should periodically be monitored and repaired if necessary.

Waterbars are berms built by a dozer, or by hand, to a one to two foot height. They serve to extend the entire width of the road, with a downslope angle between 30 and 40 percent. Waterbars are kept open at a discharge end to allow water to flow away from the road, and require little maintenance. These berms may be used as temporary or permanent structures.

Rolling Dips and Road Sloping— Rolling dips and road sloping are permanent water diversion techniques installed using natural contours of the land during road construction. These BMPs prevent water accumulation on road surfaces and divert surface runoff toward road ditches, which then convey the storm water to ponds or other management areas.

Roadway Surface Water Deflector—A roadway surface water deflector is another technique to prevent accumulation of water on road surfaces. The structure uses a conveyor belt sandwiched between two pieces of treated wood and placed within the road to deflect water. This is a useful technique for steeply graded, unpaved roads.

Culverts—Culverts are permanent surface water diversion mechanisms used to convey water off of, or underneath a road. Made of corrugated metal, they must extend across the entire width of the road, and beyond the fill slope. Additional erosion control mechanisms may need to be installed at the discharge end of the culvert.

*c. Runoff Dispersion.* Drainage systems are most effective when used in conjunction with runoff dispersion devices designed to slow the flow of water discharged from a site. These devices also aid storm water infiltration into the soil and flow attenuation. Some examples of velocity dissipation devices include check dams, rock outlet protection, level spreaders, and serrated and benched slopes.

Check Dams—Check dams are small temporary dams constructed across swales or drainage ditches to reduce the velocity of runoff flows, thereby reducing erosion and failure of the swale or ditch. This slowing reduces erosion and gullying in the channel and allows sediments to settle.

Check dams may be installed in small temporary or permanent channels where vegetation of the channel lining is not feasible and where there is danger of erosion. These may be areas where installation of nonerosive liners are not cost effective.

Check dams diminish the need for more stringent erosion control practices in the drainage ditch since they decrease runoff velocity. When constructing check dams, the use of overburden or waste rock should be avoided where there is the potential for contamination.

Rock Outlet Protection—Rock protection placed at the outlet end of culverts, channels, or ditches reduces the depth, velocity, and destructive energy of water such that the flow will not erode the downstream reach. The use of some materials (e.g., mine waste rock or ore) should be avoided where contamination may occur. As with check dams, rock outlet protection may also be used as a source reduction treatment mechanism by using rocks containing limestone or other alkaline materials to neutralize acidic discharges.

Level Spreaders—Level spreaders are outlets for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope. Level spreaders diffuse storm water point sources and release it onto areas stabilized by existing vegetation.

Serrated Slopes and Benched Slopes—These runoff dispersion methods break up flow of runoff from a slope, decreasing its ability to erode. Serrated and benched slopes provide flat areas that allow water to infiltrate, and space for vegetation to grow and reinforce soils. Serrated slopes are equipped with small steps, from one to two feet of horizontal surface exposed on each step. Benched slopes have larger steps, with vertical cuts between two and four feet high.

Contouring—Surface contouring is the establishment of a rough soil surface amenable to revegetation, through creating horizontal grooves, depressions, or steps that run with the contour of the land. Slopes may also be left in a roughened condition to reduce discharge flow and promote infiltration. Surface roughening aids in the establishment of vegetative cover by reducing runoff velocity and giving seed an opportunity to take hold and grow. This technique is appropriate for all slopes steeper than 3:1 in order to facilitate stabilization of the slope and promote the growth of a vegetative cover. Once areas have been contoured, they should be seeded as quickly as possible.

Drain Fields—Drain fields are used to prevent the accumulation of water and/ or ground water at a site, by diverting infiltrating sources through gravity flow or pumping. Typically filled with porous, permeable materials such as graded rock, or perforated pipe, and lined with geotextile fabric, these mechanisms are useful underneath significant materials, reducing the amount of water that ultimately comes into contact with significant materials.