The term Best Management Practices seems to be in the process of being phased out by the regulators and replaced by the term control measures.
Best Management Practices (BMPs)

BMPs means schedules of activities, prohibitions of practices, operation and maintenance procedures, and other management practices used to prevent or reduce pollution to waters of the U.S. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Structural

Included this slide in to provide the definition of best management practices. Some people forget that BMPs include non-structural practices and procedures and BMPs are a large part of how a permittee complies with permit conditions. BMPs can be structural or non-structural.

Examples of Nonstructural are:
- Good Housekeeping-phasing and minimizing disturbance
- Spill Control and Response
- Training
- Preventative Maintenance
- Inspections

Examples of Structural are anything that needs to be installed:
- Wattles
- Rip-rap
- Stabilized entrances and exits

Erosion vs Sediment Control

- Erosion Control, 1st line of defense
  - Purpose is to keep soil in place, minimizing suspension and transport.
  - Primary means of preventing stormwater pollution, implemented at beginning of construction and during construction as needed.
  - Used at the end of construction to permanently stabilize.

- Runoff & Sediment Control, 2nd line of defense
  - Purpose is to trap sediment.
  - Use in conjunction with properly designed and installed Erosion Control BMPs.

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Erosion Control

- Minimize disturbed area and protect natural features and soil (e.g. Preserve Existing Vegetation)
- Phase construction activity (e.g. Construction Sequencing)
- Control stormwater flowing onto and through the project (e.g. Earth Dikes/Drainage Swales and Lined Ditches)
- Stabilize soils promptly (e.g. Seeding, Mulch Cover, Soil Binders)
- Protect slopes (e.g. Geotextiles, Crown Ditch, Slope Drains)

As stated in the previous slide erosion control is the first line of defense on a construction project and its purpose is to keep soil in place, minimizing suspension and transport.

Runoff and Sediment Control

- Protect storm drain inlets (e.g. Storm Drain Inlet Protection)
- Establish perimeter controls (e.g. Silt Fence, Sediment Logs)
- Retain sediment on-site and control dewatering practices (e.g. Sediment Trap/Basin, Dewatering Operations)
- Establish stabilized construction exits (e.g. Stabilized Construction Entrance/Exit)
- Inspect and maintain controls (e.g. Inspection and Maintenance)

Runoff and sediment control are a last resort sediment leaving for a project. Runoff and sediment control BMPs should be used in conjunction with erosion controls to effectively control sediment on a project.
One of the most effective BMPs to employ is not removing vegetation. This used in conjunction with scheduling, phasing, and maintenance are probably the cheapest BMPs out there.
Slope protection is critical to install as soon as practicable to ensure that the erosional processes are limited and can consist of a variety of methods I will cover in the next few slides.

Temporary stabilization can take many forms. It can be mulch cover, or soil binders. Should be initiated within 14 days in portions of the site where construction activities have ceased temporarily or permanently.
Crown Ditch

A crown ditch is designed to intercept, divert and convey surface run-on, usually sheet flow over slopes, to prevent erosion.
The picture to the right shows how these structures can be constructed so that it blends with the natural background.

Earthen dikes / Drainage swales

As with the crown ditch, the purpose of these structures are to intercept, divert and convey surface runoff, usually sheet flow, to a desired location.
Erosion control mats/blankets can be a natural or synthetic material installed to reduce the soil erosion by wind or water. Proper soil preparation is needed prior to installing the matting or blankets.

Roughened soil slows runoff, increases infiltration, traps sediment, and improves seed germination. Photo on the bottom right shows a slope that was both mini benched and not. As you can see the area that had the benches installed is performing much better.
Runoff and Sediment Control

Wattles should be placed along the contour of the slopes, be trenched in to prevent undermining, overlapped to make sure there are no gaps, and staked in place. Their main purpose is to intercept runoff, drop sediment out, reduce flow velocities and promote infiltration. Note that the stakes on the bottom right photos are not pounded in far enough and could cause a safety issue.
Improperly Installed Wattles/Logs

Wattles/logs should not cross washes unless they are temporary and called out in the required 404 permit issued by the Army Corp of Engineers.

Poorly Maintained Wattles/Logs

BMPs lose their functionality if they are not properly maintained or replaced.
The wattles should not be placed in an area where traffic will drive over them. The area circled shows evidence of traffic over the wattles.

These wattles/logs are placed along the contour of the slope and used in conjunction with other erosion control BMPs to help attain proper stabilization.
Proper Installation of Wattles/Logs

The logs (left photo) are used as velocity dissipation devices. The bottom right photo shows sediment wattles installed in conjunction with soil track-walking.

Protect Storm Drain Inlets

Storm drains need to be protected during construction to ensure that sediment or other pollutants are not allowed to enter. Can be done in many ways, either temporarily with logs or wattles or permanently with rock mulch. This is a last line of defense to protect sediment and debris from entering the storm drain.
Protect Storm Drains/Dry Wells

Should be marked

Need to be protected and maintained

Curb Inlet Protection

A temporary filtering device placed in the flow line of completed curb inlets to protect until final stabilization is reached.

- Fill sand bags with rocks instead of sand
- Can handle a faster water flow than sediment logs or wattles
- Allows sediment to settle from runoff before water leaves the site
The most common form of perimeter control that I see is silt fence. Silt fence is a temporary sediment barrier consisting of a filter fabric that is entrenched into the soil, stretched between and attached to posts and wire fence for support.

Track-out Control

Track out is required not just for stormwater quality, but also for air quality. There are many ways of going about this, but one of the easiest is the installation of gravel. The purpose of these BMPs is to:

- Remove mud and sediment from construction vehicle tires.
- Minimize amount of mud and sediment leaving the area on vehicle tires.
- Stabilize entry/exit area to prevent tire rutting.
Track-out Control

As with all other BMPs this needs maintenance to ensure that it properly functions throughout the life of the project and that sediment is not tracked out onto the roadway.

Desilting Basin

A desilting basin is a small impoundment formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained.

- Simplify stormwater management on a construction site by trapping small amounts of sediment at multiple spots.
A small dam constructed across a roadside ditch or channel. The purpose of these are to:

- Reduce the velocity of concentrated water flows.
- Reduce channel erosion.
- Allow sediment to settle.

This BMP by definition would also be considered a post-construction BMP (permanent) since it is left in place after construction is complete. The outlet protection helps to prevent scour and reduce velocity of concentrated stormwater flows.

Photo on left should have some riprap around the top of the culvert as well to protect from run-on.
Portable toilets should be placed on a level surface where they can be secured from tipping over and away from traffic. They should never be placed in a wash. Above photos show what not to do.
Portable Toilets

The toilets have areas where stakes can be inserted to secure them to the ground.

Material Storage

Material storage should be off the ground, under cover and protected from the elements. If not, and this is especially important here in the desert, the plastic can degrade and tear, thus releasing the material to the ground’s surface.
Whether it is sweeper waste or stockpiles of other loose material, stockpiles should have BMPs implemented around them. These are procedures and practices to reduce or eliminate stormwater contact with all piled construction site material including: soil, sand and paving materials such as concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate subbase or premixed aggregate, and asphalt binder (“cold mix” asphalt).

It should be noted that if other functional site perimeter controls are maintained, control measures around temporary or active stockpiles may be redundant.

The upper left photo does not have any perimeter control, and more importantly it does not have any down slope BMPs installed. So if there was a discharge, it would go directly onto the roadway. The photos on the right show spillage outside of the BMPs.

Need to have perimeter control installed. Ideally there would be some freeboard left between the wattle and the pile to allow the pile to settle without overtopping the control measure with silt. If a berm of material is used as a control measure then it needs to be compacted to ensure that sediment will not be leaving from the berm or the stockpile.
Concrete Washout

In Arizona, under the groundwater program, APP General Permit 1.12, concrete washout is required to comply with some general conditions. It is only required to be lined (30mils thick) if it is within 20 feet of groundwater. The impoundment is located at least 50 feet from any storm drain inlet, open drainage facility, or watercourse and 100 feet from any water supply well.

The vegetation at the soil base of the impoundment is cleared, grubbed, and compacted to uniform density not less than 95%. If the impoundment is located above grade then the berms or dikes needs to be compacted to a uniform density of not less than 95%.

The washout should also be signed. Although the photo on the bottom shows the sign, there is evidence of the concrete washout material not being contained.

These are good examples of concrete washout. For the top right photo noticed that it is signed and roped off to protect it from interfering activities.
Secondary containment is required not just under the stormwater permit, but also under the Spill Prevention Control and Countermeasure (SPCC) regulation. This is to ensure that if that container were to rupture, the fluid inside would be contained and not run off of the site. Lining of fueling areas is considered under Good Housekeeping. By providing lined secondary containment, the operator is preventing the pollution of storm drains or watercourses from spills.

Both of these liners need maintenance. They have lost their intended function.
Proper storage of liquid or any other material helps to reduce the risk of discharge from leaks and spills at the construction site. The above photos are example of what not to do.

Does not have to be complicated. This is a wattle with a sheet of plastic wrapped around it to create an impervious layer. Simple and cheap.
Spills and Prevention

Leaks happen, but there needs to be some sort of response plan to deal with even the smallest of spills. Here it would be appropriate to have some sort of container to store the oily soil in while it is waiting to be disposed of.

Spills and Prevention

Need to have spill kits and proper BMPs on site to address spills if they happen.
Straw bales as BMPs are not allowed on most municipal projects; ADOT will not allow their use. They have the tendency to fall apart and cause more problems (introduction of new pollutants) than they are trying to solve.

Seeds in bales may introduce undesirable non-native plants to the area.

Bales are heavy & hard to move around (especially when water logged).