SCDOT Pipe & Culvert

Field Inventory and Inspection Guidelines

2011

Table Of Contents:

New Box Culvert with flared end and concrete apron

Executive Summary:

With almost 42,000 miles of roads, South Carolina has one of the largest state maintained highway transportation systems in the country. Underneath these roads are thousands of drainage structures. Many of these pipes and culverts were installed over 50 years ago. Out of sight and out of mind, these critical highway components need overdue attention. This document outlines a program to inventory and assess these drainage structures. This initial inventory and assessment will be the first phase of an ongoing program to inspect the condition and prioritize the repair needs of these structures.

Introduction:

Drainage structures are a hidden yet vital part of what makes a road work. It is important that these structures are assessed and maintained to keep our roads safe and useable. A pipe or box culvert is a drainage structure designed primarily to allow passage of water from one side of the embankment to the other side. Over the years, pipes and culverts less than 20 feet in length, measured longitudinally with the road, have not been regularly inspected. Since these culverts are less visible they are easy to overlook, particularly when they are performing adequately.

To develop an effective plan to manage an organization's assets, the quantity, location and condition of those assets must be known.

The initial phase of this project will be to inventory and give an initial assessment of open ended storm drainage structures 36 inches and greater in width, which cross under SCDOT maintained roads. Once an accurate inventory has been completed, an ongoing inspection program will be implemented. This inspection program will allow the SCDOT to identify and prioritize needed work throughout the state.

These inspections will be hands-on, out-of-the-vehicle inspections. The work should be entered into the Highway Maintenance Management System (HMMS) Daily Work Report using Activity Code "Inspections- 908" and the "Culvert" Work Description. The beginning and ending mile points should be the same as the centerline of the inlet side of the culvert. A separate location shall be entered for each culvert assessed, include latitude and longitude.

This guide has been developed to provide the local maintenance organizations with a standard method for inventory and standard guidelines for assessment of their drainage structures.

Purpose:

This inventory and assessment program will provide a comprehensive review of the culverts located under the SCDOT's roadway system. It will provide not only a physical count of this feature, but also, an evaluation of the condition of each culvert. This information will allow the SDOT to accurately identify and effectively manage the culverts in our system. The inventory information gathered in the field will be entered into HMMS in the drainage structure inspection module. It is extremely important that this inventory of culverts be kept current. Therefore, the inventory information in HMMS must be updated as additional culverts are installed or existing culverts are repaired or removed. It is the District's responsibilities to ensure that the data in HMMS is complete, accurate and kept current.

Once the initial inventory and assessment phase is completed a periodic assessment schedule will be developed. As these periodic assessments are performed the condition rating will be updated and used to identify areas of need and concern. Once maintenance needs are identified, they can be prioritized and addressed as funding becomes available.
The following guidelines provide guidance for the inspection, maintenance and prioritizing the repair of these culverts. This manual does not provide instruction as to how repairs to these culverts are to be performed.

Safety:

As with any work that the SCDOT engages in, safety is our first concern. Inspecting drainage structures presents many hazards to an inspector. However, it is impossible to foresee every hazard that may exist at any given site. Therefore, a high level of attention and awareness of the inspection environment and good judgment are vital to the safety of the inspector.

Site assessments, pre-planning and field safety meetings shall be held prior to close-up inspection and/or repair. Small culvert crossings may hold numerous hazards at the time of inventory, future inspections and repairs.

All employees entering the pipe culvert approach area must have completed all required training, including Safety Awareness Orientation, Confined Space, Excavation, Personal Protective Equipment [PPE], Fall Protection, and an appropriate level of Work Zone Safety Awareness courses.

Inspections shall be conducted with at least two inspectors. The inspectors shall have two way communication devices and the proper PPE including safety boots, hardhat, safety glasses, safety vest, and work gloves as a minimum. A type 5 Coast Guard approved lifejacket may be required if working over or near water. A probing device is recommended where water is present in the ditch.

Potential Hazards:

Confined Space

OSHA defines a confined space as a space that is large enough for an employee to enter, has restricted means of entry or exit, has unfavorable natural ventilation and is not designed for continuous employee occupancy. Do not enter a confined space or break the plane of entry with any part of your body until you have fully complied with the confined space entry procedure set forth in Department policy.

Entry into permit–required confined spaces can be extremely dangerous. Possible hazards can include:

- Oxygen deficiency
- Fire, explosion hazards
- Exposure to dangerous vapors and toxic gases
- Physical hazards

OSHA estimates that almost sixty-six percent (66%) of the deaths in confined spaces each year result from people attempting to rescue someone else.

OSHA 29CFR, 1910.146 specifies regulations governing entry into confined spaces. Personnel involved in or having responsibility for entry into confined spaces must be thoroughly familiar with permit entry and rescue procedures, as well as SCDOT's Confined Space Policy. Contact your District Safety Coordinator or the Safety Office at (803) 737-1161 if you have any questions regarding confined space entry.

Drowning

Scour is the erosion of the stream bed. This type of erosion can result in areas of the stream bed that are significantly deeper than the surrounding area and significantly deeper than the depth of the water flowing through the culvert barrel. It is recommended that inspectors probe the stream bed prior to entering.

Flash floods can also be a hazard to the culvert inspector. Flash floods can occur in a drainage structure even if there is no rain falling at the structure. Before entering a drainage culvert or channel the inspector should have a good knowledge of the weather forecast and exercise sound judgment when storms are forecast.

Potential Hazards:

Traffic

The inspector should always remember that working on or near the roadside is a dangerous environment. An approved safety vest should always be worn. Care should be taken to park as far away from the travel lane as is safely possible. Always be vigilant and monitor traffic behavior in your work area. SCDOT work zone safety guidelines should be followed.

Slips and Falls

The ditch banks and embankments around drainage culverts can be steep and slippery. Additionally, debris and vegetation can be trip hazards or obscure holes or objects that could cause a fall or injury. The inspector must exercise caution when navigating these slopes.

Wildlife

Accumulations of debris and vegetation in the vicinity of the culvert can harbor snakes, rodents, insects and other animals that could pose a hazard to the inspector. Poisonous plants can be, and often are, present in the vicinity of the drainage culvert. The inspector should assess the possibilities of these hazards prior to descending the embankment and take the proper precautions.

In some areas of the state, alligators could be present in or near culverts .

Toxins

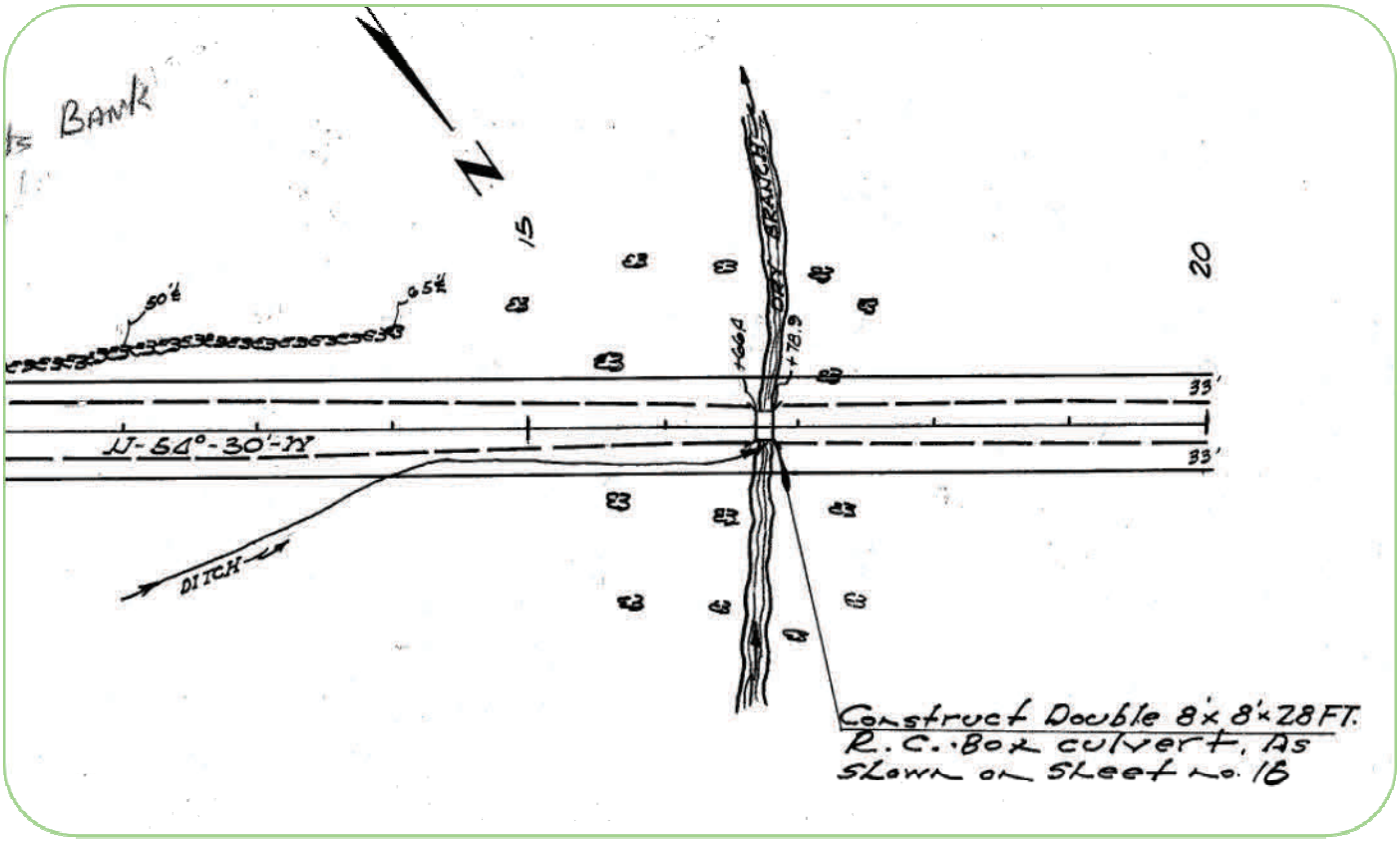
Streams can carry toxic or harmful chemicals usually from leaking or spilled chemical storage containers. On rare occasions fire and explosion has occurred in storm drainage systems. Exercise caution if you suspect toxic chemicals are in the water.

If you have any questions or need assistance, please contact your District Safety Coordinator or the Occupational Safety Office.

Inventory:

The first step to inventory a culvert is to identify its location. It is recommended that road plans (where available) be reviewed prior to field verification. This will decrease the possibility of missing culverts during the field inspection. The following information should be recorded;

- District.
- County.
- Inspectors.
- Date – date of inspection.
- Type – route type.
- Route – route number.
- Aux. – route auxiliary type.
- Mile Point - measured at centerline of inlet.
- Latitude - measured at centerline of inlet and outlet.
- Longitude - measured at centerline of inlet and outlet.
- Purpose – Constructed Ditch, Natural Stream, Other.
- Orientation – Transverse, Skewed, Longitudinal.
- Position of inlet - median or shoulder.
- Position of outlet - median or shoulder.
- Fill height greater than 15 feet.
- New pipe accepted with remediation.



The second step is to identify the type and size of the drainage pipe or culvert. The following information should be recorded;

Inventory Cont:

Material:

Culverts or pipes are typically constructed of reinforced concrete (RCP), Corrugated Metal Pipe (CMP) – non aluminum, Corrugated Aluminum Pipe (CAP), High Density Polyethylene Pipe (HDPE) or other materials.



Number of culvert barrels or pipes in one location:

There are instances where multiple lines of pipe or culverts with multiple barrels have been installed at one location. Indicate the number of separate pipes or barrels that exist at each location. For example, a location that has two separate pipes installed would be recorded as a quantity of "2" and a ten foot wide box culvert that is divided into two five foot wide barrels would be recorded as "2" in the column next to the material type. A separate assessment should be completed for each line of pipe. If the area of the barrels is different a separate inventory must be filled out for each size barrel.

Barrel Area:

This is the measured width and height, of the culvert, or diameter, of the pipe, opening. (i.e. inside measurement)

Culvert length:

This is the actual length of the culvert. The length should not be measured along the slope of the shoulder and ditch.

Culvert shape:

This is the shape of the culvert barrel. Typically culverts are boxes, circles or ellipses, however, other shapes do exist.

New elliptical concrete pipe

Old elliptical corrugated metal pipe

Culvert Liner:

If a liner is present record the material type and the inside diameter or the inside width and height.

The next step is to identify and record the Inlet and Outlet features.

Pipe End Type: Three different types of pipe ends exist. Beveled, Flared, and Flat. These are described in greater detail in the glossary.

Inlet and Outlet end treatment types: Several different types of end treatments exist. Headwall, wing wall, bevel, flare, flat, and rip rap are the most common types. These are described in greater detail in the glossary.

HDPE pipe with flared concrete end section

RCP with headwall and wingwalls

Aprons: These are described in greater detail in the glossary.

Finally, a condition assessment should be made.

Condition Assessment:

The condition assessment should consist of a thorough inspection of three major areas of the culvert structure. These areas are the barrel, inlet, and outlet, In general, you are looking for performance or condition issues. Condition issues include but are not limited to corrosion, separations and cracks in the structural elements of the culvert. Performance issues include but are not limited to piping, sedimentation, vegetation around inlets and outlets, and undermining or scour. The inspection should be planned according to the culvert type, structure and material. All findings shall be recorded on the Culvert Assessment Form. Asset numbers will be assigned by HMMS. Only fill out the asset number area if you know the number. Assessment items should be recorded on a one to five scale. Consult the "Assessment Guidelines" section of this document for proper grading guidance. Use a zero (0) for the grade if the item is not applicable.

Inspection Method:

To ensure an accurate and complete inspection is performed, a logical procedure should be established and followed. The following is a standard and accepted methodology of culvert inspection. It is important that this methodology is followed to ensure uniformity of practice statewide.

1. Plan the inspection, notify your supervisor, and review available information prior to beginning the actual field review.
2. Observe the overall condition of the area around the culvert.
3. Observe the roadway and shoulder in and around the culvert.
4. Assess the waterway or channel and record findings.
5. Assess condition of the inlet end of culvert and record findings.
6. Assess condition of the outlet end of culvert and record findings.
7. Assess condition of the barrel and record findings.

Plan and Review:

1. Plan your inspection carefully. Create a checklist of tools and other items to take with you for the inspection. A large investment of time is made just getting to the inspection site so make sure you have all the tools you need to complete the job.
2. Review prior inspections to familiarize yourself with the structure and existing conditions. This review should alert you to areas that need extra attention or the need for special tools. Take the prior review with you for reference while on site.
3. Notify the RME or your supervisor of your inspection schedule prior to departure.
4. Fill out the top section of the assessment form.

Observe Overall Conditions:

1. Observe the condition of the shoulders, traffic and water level to identify potential hazards that could jeopardize your safety.
2. Observe overall conditions of the area while approaching the culvert. These conditions could indicate a need to modify the inspection sequence or indicate areas that may need extra attention.
3. Look for land use changes that could affect the runoff characteristics of the drainage basin, like going from an agricultural use to a commercial use or construction activity.
4. Observe the condition of the roadway over the culvert. Look for settlement across the entire roadway. Full width patches are also an indication of settlement issues. Look for sinkholes or pothole patches in the pavement above the culvert. These are indicators of soil infiltrating into the barrel.
5. Look for sinkholes or new fill on the shoulders above the culvert
6. Look for eroded areas or gullies near the culvert ends.
7. Check for proper signage.

Inlet and Outlet:

1. Observe the horizontal alignment of the channel and the structure.
2. Inspect the channel bed for scour.
3. Inspect the area around the inlet and outlet for blockages due to sediment.
4. Inspect the area around the inlet and outlet for blockages due to vegetation.
5. Inspect the channel banks for erosion.
6. The end treatments should be checked for cracks, separation and scour.
7. The inlet and outlet should be checked for any blockages due to vegetation growth.
8. The inlet and outlet should be checked for blockages like debris, sediment, beaver dams or other blockage.
9. The inlet and outlet of the barrel should be inspected for any issues like corrosion of the barrel, or corrosion of reinforcing steel.

Record all observations on the Culvert Assessment Form.

Culvert Barrel:

1. The general condition of the culvert should be assessed. Look for corrosion, cracks alignment, sediment, joint separation, piping and blockages.
2. Many culvert barrels can be inspected from the ends by using a flashlight, binoculars and extra care.
3. If additional evaluation of the barrel is necessary the RME should contact the DOM office for guidance. It is likely that specialized equipment can be obtained to complete the assessment. **Under no circumstances should unqualified personnel enter into a confined space.**

Record all observations on the Culvert Assessment Form.

Assessment Guidelines:

Listed below are the items that will be assessed. For each possible deficiency there is a rating score and a definition for that rating. Choose the rating that most closely describes the actual condition and place that rating in the appropriate location on the assessment form.

Inlet & Outlet

Alignment

Rating	Description
5.	Channel and culvert are aligned.
4.	Channel and culvert are within plus or minus 15 Degrees alignment.
3.	Channel and culvert are greater than 15 degrees and less than 45 Degrees misaligned.
2.	Channel and culvert are greater than 45 Degrees misaligned.
1.	Channel is parallel to road or undermining embankment or road.

Erosion

Rating	Description
5.	No erosion evident.
4.	Some erosion to stream bank or fill.
3.	Moderate erosion to stream bank or fill.
2.	Heavy erosion to stream bank or fill.
1.	Erosion threatening roadway.

Cracked

Rating	Description
5.	No cracks in structure.
4.	Some minor cracking less than 1/8”.
3.	Some Cracks in excess of 1/8” efflorescence is evident, some rust streaks may be evident.
2.	Large cracks are evident greater than 1/4”, extensive cracking, exposed rebar.
1.	Cracks greater than 1”, exposed rebar and extensive spalling of concrete surface.

Separated

Rating	Description
5.	No separation between barrel and or structure.
4.	Minor separation less than 1/8”.
3.	Medium separation less than 1/2”.
	Major separation in excess of 1 1/2”.
	Total separation in excess of 3”.

Scour

Rating	Description
5.	No undermining or scour.
4.	Minor scour or erosion at base of structure but not extending under structure.
3.	Scour or erosion at base of structure extending underneath structure up to 12”.
2.	Scour or erosion at base of structure extending underneath structure up to 24”.
1.	Scour or erosion at base of structure extending underneath structure in excess of 24”.

Inlet & Outlet Continued:

Vegetation

Rating	Description
5.	No vegetation at inlet or outlet.
4.	A little vegetation at inlet or outlet no impediment to flow.
3.	Some vegetation at inlet or outlet, potential to impede flow.
2.	Heavy vegetation at inlet or outlet impeding flow and gathering other debris.
1.	Vegetation severely blocking the inlet or outlet.

Blocked

Rating	Description
5.	There is no Blockage.
4.	Some debris blocking flow.
3.	Debris blocking flow little or moderate water back up.
2.	Debris blocking flow. Water backing up due to blockage.
1.	Totally blocked no flow culvert acting as a dam.

Separation rating 1

Corrosion

Rating	Description
5.	The material appears new or very close to new. There may be some minor pitting, slight corrosion.
4.	The material has moderate to fairly heavy corrosion and/or deep pitting but very little to no thinning of the material.
3.	Extensive corrosion, heavy pitting, and some perforations of the material.
2.	Extensive perforations due to corrosion.
1.	Large areas of material are missing, complete deterioration, full or partial collapse has occurred.

Barrel:

Assessment Guidelines:

Corrosion

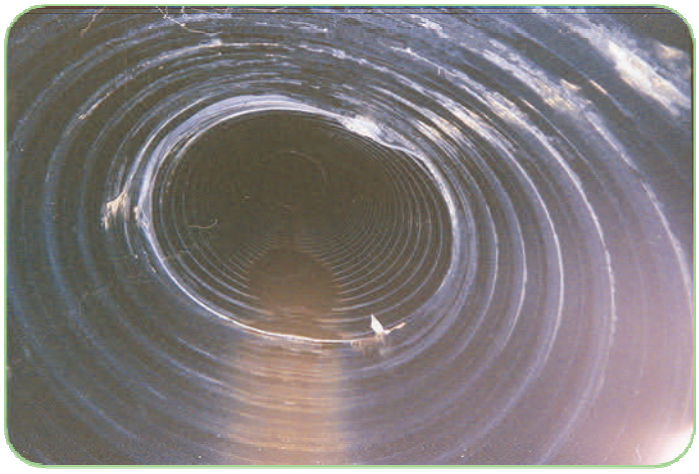
Rating	Description
5.	The culvert appears new or very close to new. There may be some minor pitting, slight corrosion.
4.	The culvert has moderate to fairly heavy corrosion and/or deep pitting but very little to no thin ning of the material.
3.	Extensive corrosion, heavy pitting, and some perforations of the material.
2.	Extensive perforations due to corrosion.
1.	Large areas of material are missing, complete deterioration, full or partial collapse has occurred.

Cracked

Rating	Description
5.	The culvert appears new or very close to new. No cracks are evident.
4.	The culvert is in good condition with some minor to extensive hairline cracks and no spalling of concrete.
3.	Culvert is in fair condition. There are extensive cracks and areas with spalling.
2.	Culvert is in poor condition. There is extensive spalling with exposed reinforcing steel.
1.	Large areas of material are missing, complete deterioration, full or partial collapse has occurred.

Alignment

Rating	Description
5.	The culvert appears new or very close to new. Alignment is good and joints are tight.
4.	The culvert is in good condition some minor settlement and misalignment in isolated areas.
3.	Culvert is in fair condition. There is minor misalignment and or settlement throughout barrel. Minor ponding is evident due to the misalignment.
2.	Culvert is in poor condition. There is poor alignment. Severe ponding is evident due to the poor alignment.
1.	Culvert not functioning due to misalignment.



HDPE pipe barrel with misalignment and minor ponding. Alignment rating 3

CMP Culvert with slight corrosion. Corrosion rating 5

Culvert blocked with a Beaver Dam
Blocked rating 2

Barrel Cont.:

Sediment

Rating	Description
5.	There is no sediment.
4.	There is sediment but less than 25% of the area of the barrel.
3.	Sediment is greater than 25% of the area of the barrel.
2.	Sediment is greater than 50% of the area of the barrel.
1.	Sediment is greater than 75% of the area of the barrel.

Joint Separation

Rating	Description
5.	All joints are tight there is no joint separation.
4.	There are some minor separations, 1/2" or less, in isolated areas.
3.	Either minor separation in several areas or some major separation, greater than 1", at one or several areas. There is isolated sedimentation from infiltration.
2.	There are major separations greater than 1" in several areas of the barrel and evidence of infiltration is extensive.
1.	There is severe joint separation in excess of 6" and/or end sections are dropping off. Infiltration has caused severe sediment issues or piping.

Piping

Rating	Description
5.	No piping is occurring.
4.	Piping may be occurring.
3.	Some water appears to be seeping around outside of barrel.
2.	Some of the flow is occurring outside of barrel.
1.	The majority of flow is occurring outside of the barrel.

Blocked

Rating	Description
5.	There is no blockage.
4.	Some debris in culvert bottom with the potential to impede flow.
3.	Debris is partially blocking culvert with evidence of minor ponding.
2.	Debris is blocking culvert with evidence of significant ponding.
1.	Totally blocked with no flow. Culvert is acting as a dam.

Glossary:

Apron: Usually a horizontal structure used to reduce erosion and improve hydraulic efficiency at inlets and outlets. Aprons are often concrete or rip rap but sometimes are made of other materials. Most have a cut off wall to protect against undermining.

Aux: The route Auxiliary Code. (i.e Bus, Con, Alt, Byp)

Barrel: The pipe or box section that carries the water under the roadway.

Beveled End: A beveled end section is a section that is manufactured or cut so that the top of the barrel is closer to the embankment than the bottom of the barrel.

Culvert: A structure that conveys water or forms a passageway through an embankment and is designed to support a super-imposed earth load or other fill material plus live loads. For the purposes of this manual, a culvert will consist of all of the following even though they may support traffic loads directly:

1. Any structure with a span, diameter, or multi-cell structure, having a total span of less than 20 feet when measured parallel to the centerline of the roadway.

2. Any structure that forms a passageway or conveys water through an embankment not inspected according to the definitions and terms of the South Carolina Department of Transportation Bridge Inspection Manual.

Drainage Ditch: A man made waterway to drain a low area or to channel water to a desired place.

Beveled End on the left and Flat End on the right

Glossary Cont.:

End Section: Usually a concrete or metal structure attached to the end of a culvert to improve hydraulic efficiency and anchorage.

Invert: The lowest point on the conduit cross section.

Fill Height: The depth of backfill over the pipe.

Flared End: A flared end section flares out horizontally to a greater dimension than the barrel of the culvert.

Flat End: A flat end section has an end that is perpendicular to the line of the barrel.

Flexible Pipe: A conduit made of corrugated or spiral rib steel, aluminum, or plastic.

Headwall: A structure placed at the inlet or outlet of a culvert to protect the embankment slopes, and prevent undercutting, usually a concrete structure. Headwalls are perpendicular to the line of the barrel

Intermittent Stream: A natural waterway that is sometimes dry that carries surface run off during and after rain events.

Live stream: A natural waterway that carries water almost all of the time.

Masonry Structure: A structure made of stone, brick, or other block units.

Flared End Section

Glossary Cont.:

Piping: Water flowing along the outside of the culvert, which over time erodes the soil around or underneath the culvert barrel.

Pipe accepted with remediation: This field is for the construction office to check when adding new construction culverts to the inventory.

Rigid Pipe: A conduit made of concrete or clay.

Rip Rap: Large dense aggregate placed in various locations to dissipate the energy of moving water and prevent erosion and scour.

Route: Route number

Scour: Degradation of the culvert's outlet channel due to erosive velocities. This means wearing away of the channel bottom due to the flow of water. You will see a hole in the bottom of the channel, often near the end of the culvert.

Sediment: Soils and other materials that settle out of suspension and build up on the bottom of a

Severe Corrosion - Corrosion Rating 1

Glossary Cont. :

Skew: Angle measured between the centerline of the culvert and a line perpendicular to the centerline of the roadway.

Storm Sewer: A conduit or pipe drainage system that conveys storm water, subsurface water, or a similar discharge. A storm sewer has closed ends such as catch basins, inlets, or manholes.

Type: The type of route (S, SC, US, I, R or RS)

Wetland: A wetland is an area where water either covers the soil or is present at or near the surface, particularly in the root zone, at least a good portion of the year. Swamps, bogs, and marshes are examples of wetlands. Wetlands can be permanent, seasonal or tidal.

Wingwall: A structure placed at the inlet or outlet of a culvert to protect the embankment slopes, and prevent undercutting, usually a concrete structure. Wingwalls are usually made of a section of wall perpendicular to the line of the barrel and a "wing" on one or both sides that project at an angle from the perpendicular section of the wall away from the culvert

Work County: The County where the Culvert is located.

Headwall and Wingwalls with Rip Rap

Suggested Equipment Checklist:

- Safety Vest
- Hard Hat
- Safety Glasses
- Work Gloves
- Work Boots
- Hip Boots
- Personal Flotation Device
- Signs and Cones
- Flashing Lights on Vehicle
- Tape Measure ~ 20’ retractable
- Tape Measure – 100’
- Clip Board
- Pencil
- Flashlight
- Binoculars
- Level
- Digital Camera
- GPS device
- Probing Pole with Graduations for Measurements
- Crack Gauge or Ruler with 1/16” graduations
- Sharpe Marker
- Culvert Inventory Forms
- Culvert Assessment forms
- Prior assessment forms (for reference)

Culvert Inventory Form:

District	Work County	Date	Type	Route #	Aux	Mile Point	
						BMP	EMP
Inlet		Outlet					
Latitude	Longitude	Latitude	Longitude				

Fill Height > 15'(check if yes)		Pipe Accepted w/remediation check if yes				**Purpose:**	
Orientation:	Transverse		**Inlet Position:**		**Outlet Position:**	Constructed Ditch	
	Longitudinal		Shoulder		Shoulder	Natural Stream	
	Skewed		Median		Median	Other	

BARREL

	Material:		**# Barrels:**		**Area:**		**Length:**	**Shape:**	
	CAP				Diameter			Circle	
	CMP				Width			Ellipse	
	RCP				Height			Box	
	HDPE							Other	
	Masonry								
	Mixed/Other								

LINER

	Materials:		**Area:**		Notes:
	CMP		Diameter		
	Concrete		Width		
	Fiberglass		Height		
	Plastic				
	Other				

INLET

	Pipe End Type:		***Inlet End Treatment Type:***		***Apron:***			
	Beveled		Head Wall		Concrete			
	Flared		Wing Wall		Asphalt			
	Flat		Rip Rap		Stone			
			None		Other			
					None			

OUTLET

	Pipe End Type:		***Outlet End Treatment Type:***		***Apron:***			
	Beveled		Head Wall		Concrete			
	Flared		Wing Wall		Asphalt			
	Flat		Rip Rap		Stone			
			None		Other			
					None			

Inspector Signature:	**Inspector Name (Printed):**
1.	1.
2.	2.

Culvert Assessment Form:

Work County	Type	Route	Aux	Mile Point		Date	Asset #
				BMP	EMP		

INLET

Headwall		*Apron*		*End Section*					
Cracked		Cracked		Cracked		Vegetation		Alignment	
Separated		Separated		Separated		Blocked		Erosion	
Scour		Scour		Scour		Corrosion			

OUTLET

Headwall		*Apron*		*End Section*					
Cracked		Cracked		Cracked		Vegetation		Alignment	
Separated		Separated		Separated		Blocked		Erosion	
Scour		Scour		Scour		Corrosion			

BARREL

Corrosion		Alignment		Joint Separation		Blocked	
Cracked		Sediment		Piping			

Comments:

Inspector Signature:	Inspector Name (Printed):
1.	1.
2.	2.