Appendix B  Drainage Facility Condition Surveys Guideline

Existing drainage facilities including pipes, catch basins, manholes, junction chambers, sedimentation/gross particle separators, cross culverts and ditches/swales which are scheduled to remain in use as part of the project should be inspected to verify their general condition early in the design process. A condition survey must be conducted for drainage systems that already have a service life of 10 years or more. Available previous condition reports should be reviewed prior to inspection to identify critical areas that need special attention.

Visual inspection should be performed to verify the existing drainage facilities’ condition by referencing the AASHTO Highway Drainage Guidelines Volume XIV, CULVERT INSPECTION MANUAL (FHWA-IP-86-2), CULVERT REPAIR PRACTICES MANUAL Volume I (FHWA-RD-94-096), CULVERT REPAIR PRACTICES MANUAL, Volume II (FHWA-RD-95-089), and the Department’s Bridge Inspection Manual. The inspection should be conducted in conformance with the Department’s confined space program. Where siltation build-up hampers inspection, the drainage systems should be cleaned and visually inspected prior to recommending a video inspection. Normally video inspection of pipes should only be done if there is an indication that there may be evidence of distress such as roadway settlement, pavement patches, roadway build-up or embankment failure.

The condition survey should be documented in a report that includes the time and date of inspection; plans with sketches and measurements; itemized listing of the drainage facilities’ location and condition; and photographic evidence of drainage facility/roadway section/embankment side slope erosion or failure. The report should also include expected service life and recommendations considering life cycle analysis; and specific recommendations on how the identified deficient drainage facilities can be remedied to avoid potential problems during construction. A copy of the report should also be provided in electronic format.

The designer should consult with the Drainage Engineer of the appropriate Departmental District for past problems, site conditions and proposed future improvements.

The following key elements where appropriate should be identified as part of the condition survey:

Structures

- Siltation, debris
- Crack, spall, settlement, etc.

Pipe / Culvert

- Corrosion, abrasion of pipes and bolt
- Water leakage
- Joint, seam defect and misalignment
- Cracking
- Visible waterline
- Deformation of pipe cross section
Pipe material (concrete, steel, masonry stone, plastic, etc.)
Siltation, debris

**Inlet / Outlet**

- Erosion
- Siltation, debris
- Condition of inverts (buried)
- Piping
- Condition of culvert ends / headwalls / wingwalls
- Undermining
- Scouring
- Outlet protection (type, limits and condition)
- Waterway condition

**Roadway / Embankment Slope**

- Settlement
- Cracking
- Patching
- Frequent overlays
- Erosion
Form 1: STORM SEWER SYSTEM – PIPES BETWEEN DRAINAGE STRUCTURES

Station, Offset: ___________________________  Project No. ________________
Type: ________________________________  Route No. ________________
Size: ________________________________  Date ________________
Length: ________________________________

<table>
<thead>
<tr>
<th>Condition Rating *</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0-9)</td>
<td>Good</td>
</tr>
<tr>
<td>Siltation, Debris</td>
<td></td>
</tr>
<tr>
<td>Visible Waterline</td>
<td></td>
</tr>
<tr>
<td>Water Leakage</td>
<td></td>
</tr>
<tr>
<td>Alignment</td>
<td></td>
</tr>
<tr>
<td>Joints</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td></td>
</tr>
<tr>
<td>Horizontal Diameter</td>
<td></td>
</tr>
<tr>
<td>Seams</td>
<td></td>
</tr>
<tr>
<td>Corrosion and Rust</td>
<td></td>
</tr>
</tbody>
</table>

* - See Tables B-1 and B-2 for ratings. These tables may be used for various pipe materials (where appropriate).

Remarks/Findings:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Recommendations:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
FORM 2: STORM SEWER SYSTEM – DRAINAGE STRUCTURES

Station, Offset: ___________________________  Project No. ______________
Type: _______________________________  Route No. ______________
Date ________________________________

<table>
<thead>
<tr>
<th>Condition</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crack, Spall, Settlement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siltation, Debris</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks/Findings:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Recommendations:
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

ConnDOT Drainage Manual  October 2000
FORM 3: STORM SEWER SYSTEM – INLET/OUTLET FACILITIES TO/FROM CHANNEL, DITCHES, ETC…

Station, Offset: ___________________________  Project No. ____________
Type: ___________________________  Route No. ____________
Outlet Protection (type and limits): _________________________  Date _____________

<table>
<thead>
<tr>
<th>Condition</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inverts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siltation, Debris</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culvert Ends</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wingwalls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headwalls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undermining</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterway Adequacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet Protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks/Findings:
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Recommendations:
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
# RATING GUIDELINES FOR ROUND CORRUGATED METAL PIPE BARRELS

## Table B-1

<table>
<thead>
<tr>
<th>RATING</th>
<th>CONDITION</th>
<th>RATING</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>New condition</td>
<td>4</td>
<td>Shape: marginal significant distortion throughout length of pipe, lower third may be kinked</td>
</tr>
<tr>
<td>8</td>
<td>Shape: good, smooth curvature in barrel - Horizontal: within 10 percent of design Seams and joints: tight, no openings Metal: - Aluminum: superficial corrosion, slight pitting - Steel: superficial rust, no pitting</td>
<td>3</td>
<td>Shape: poor with extreme deflection at isolated locations, flattening of crown, crown radius 20 to 30 feet</td>
</tr>
<tr>
<td>7</td>
<td>Shape: generally good, top half of pipe smooth but minor flattening of bottom - Horizontal diameter: within 10 percent of design Seams or joints: minor cracking at a few bolt holes, minor joint or seam openings, potential for backfill infiltration Metal: - Aluminum: moderate corrosion, no attack of core alloy - Steel: moderate rust, slight pitting</td>
<td>2</td>
<td>Shape: critical, extreme distortion and deflection throughout pipe, flattening of crown, crown radius over 30 feet</td>
</tr>
<tr>
<td>6</td>
<td>Shape: fair, top half has smooth curvature but bottom half has flattened significantly - Horizontal diameter: within 10 percent of design Seams or joints: minor cracking at bolt is prevalent in one seam in lower half of pipe. Evidence of backfill infiltration through seams or joints Metal: - Aluminum: significant corrosion, minor attack of core alloy - Steel: fairly heavy rust, moderate pitting</td>
<td>1</td>
<td>Shape: partially collapsed with crown in reverse curve</td>
</tr>
<tr>
<td>5</td>
<td>Shape: generally fair, significant distortion at isolated locations in top half and extreme flattening of invert - Horizontal diameter: 10 percent to 15 percent greater than design Seams or joints: moderate cracking at bolt holes along one seam near bottom of pipe, deflection of pipe caused by backfill infiltration through seams or joints Metal: - Aluminum: significant corrosion, moderate attack of core alloy - Steel: scattered heavy rust, deep pitting</td>
<td>0</td>
<td>Pipe: totally failed</td>
</tr>
</tbody>
</table>

ConnDOT Drainage Manual October 2000
### RATING GUIDELINES FOR REINFORCED CONCRETE PIPE BARRELS

**Table B-2**

<table>
<thead>
<tr>
<th>RATING</th>
<th>CONDITION</th>
<th>RATING</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>New condition</td>
<td>4</td>
<td>Alignment: marginal; significant settlement and misalignment of pipe; evidence of piping; end sections dislocated about to drop off</td>
</tr>
</tbody>
</table>
| 8      | **Alignment**: good, no settlement or misalignment  
**Joints**: tight, with no defects apparent  
**Concrete**: no cracking, spalling, or scaling present; surface in good condition | 3      | **Alignment**: poor with significant ponding of water due to sagging or misalignment of pipe; end section drop off has occurred  
**Joints**: significant openings; dislocated joints in several locations exposing fill material; infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway  
**Concrete**: extensive cracking; spalling, and minor slabbing; invert scaling has exposed reinforcing steel |
| 7      | **Alignment**: generally good; minor misalignment at joints; no settlement  
**Joints**: minor openings, possible infiltration/exfiltration  
**Concrete**: minor hairline cracking at isolated locations; slight spalling or scaling present on invert | 2      | **Alignment**: critical; culvert not functioning due to alignment problems throughout  
**Concrete**: severe slabbing has occurred in culvert wall, invert concrete completely deteriorated in isolated locations |
| 6      | **Alignment**: fair, minor misalignment and settlement at isolated locations  
**Joints**: minor backfill infiltration due to slight opening at joints; minor cracking or spalling at joints allowing exfiltration  
**Concrete**: extensive hairline cracks, some with minor delaminations or spalling; invert scaling less than 0.25 in. deep or small spalls present | 1      | Culvert: partially collapsed  
**Road**: closed to traffic |
| 5      | **Alignment**: generally fair, minor misalignment or settlement throughout pipe; possible piping  
**Joints**: open and allowing backfill to infiltrate; significant cracking or joint spalling  
**Concrete**: cracking open greater than 0.12 in. with moderate delamination and moderate spalling exposing reinforcing steel at isolated locations; large areas of invert with surface scaling or spalls greater than 0.25 in. deep | 0      | Culvert: total failure of culvert and fill  
**Road**: closed to traffic |