CCTV Inspection

Guidelines for
Acceptance of Sewers

OCTOBER 2009

Los Angeles County
Sewer Maintenance Division
Consolidated Sewer Maintenance District

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Technical Specifications

1. GENERAL DESCRIPTION OF THE WORK

1.1 The CCTV inspection work must be completed by certified National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) trained operator(s) using established PACP coding and observations.

2. WORK AND MATERIALS PROVIDED BY THE CONTRACTOR

GENERAL:

2.1 The Contractor shall provide all required traffic control, including warning lights and traffic cones, as needed or required in accordance with the Watch Manual, as well as any city-required traffic plans.

2.2 The Contractor shall obtain all permits required by the local jurisdiction.

SEWER CLEANING:

2.3 Sewers will be cleaned by removing grit, loose solids, grease, and any construction debris that are present.

2.4 Cleaning shall be completed by the Contractor within 72 hours and no less than one hour prior to inspection to reduce the impact of the natural flow within the pipeline during inspection.

2.5 The Contractor shall trap all debris at the end manhole and properly dispose and haul away debris when cleaning pipe segments.

SEWER INSPECTION:

OPERATORS

2.6 Video inspection shall be performed by a certified NASSCO PACP trained operator.

EQUIPMENT

2.7 The Contractor's CCTV equipment shall include video cameras, a video monitor cable, power sources, and all equipment necessary to perform a CCTV inspection as outlined in this Technical Specifications.

2.8 The cameras shall meet Cal-OSHA requirements for operating in the sanitary sewer environment.

2.9 The cameras shall have Pan-and-Tilt capabilities, and shall have a minimum of 360 x 270 degree rotation and illumination sensitivity shall be three lux or less and provide a minimum of 460 lines of resolution. The

focal distance shall be adjustable through a range from 25 mm (1 inch) to infinity.

2.10 During CCTV inspection, lighting intensity shall be adjusted to minimize glare. Lighting and picture quality shall be adjusted to provide a clear, in-focus picture of the entire periphery of the pipeline for all conditions encountered.

2.11 All camera systems shall be able to navigate around minor objects, roots, and debris. The system used to move the camera through the pipe shall not obstruct the camera's view or interfere with proper documentation of the sewer conditions.

2.12 The camera cable shall be retracted to remove slack and to ensure an accurate footage reading.

2.13 The distance shall be measured between the exit of the start manhole and the entrance of the finish manhole for a true measurement of the length of the pipe segment, as required by PACP. It shall be recorded in standard units and the video display readout shall display units to one-tenth of a foot.

2.14 The cable footage-counter shall be accurate to plus or minus 2 feet per 1,000 feet.

2.15 Video inspection and reporting shall be submitted in a NASSCO-compatible format.

2.16 The camera lens shall be kept clear of condensation and debris during the CCTV inspection.

OBSERVATIONS

2.17 All observations and defects shall be documented in a database and shall include digital video recording and digital photographs as defined in Sections 2.24 and 2.25.

2.18 Each video clip and photograph provided shall correspond to inspection data in the database, and each set of inspection data listed in the database shall be properly linked to the appropriate video clip and photos.

2.19 All observations shall be selected from a standard table of descriptions incorporated in the inspection reporting software, as required by PACP. Any additional comments regarding the observation shall be indicated in the remarks box.

2.20 The severity of each defect or observation shall be recorded and rated according to the PACP method.

2.21 All observations shall be recorded using PACP codes as outlined in NASSCO's PACP Reference Manual, and in this document.

2.22 Video

2.22.1 The Contractor shall make a continuous color digital recording in MPEG 4 format for each pipe segment inspected, unless specified by CSMD.

2.22.2 Video files shall have a minimum resolution of 352 x 240 pixels and an interlaced frame rate at a minimum of 24 frames per second.

2.22.3 Audio reporting will be avoided to prevent inconsistent operator subjectivity.

2.22.4 Video inspection will not exceed a traverse rate of 30 feet per minute.

2.22.5 The Contractor shall pause the digital recording at any time there is a delay in the inspection and restart the digital video recording in the same digital file. The pause shall in no way affect, freeze, or interrupt the replay of the video and shall not close the video file during the inspection.

2.22.6 Each pipe segment (manhole to manhole) shall be identified with an initial text screen and completed in accordance with PACP's CCTV inspection form header Instructions and shall be as follows:

Line	Number & Description
Line 1:	Surveyed By
Line 2:	City
Line 3:	Street
Line 4:	Location Code*
Line 5:	Weather*
Line 6:	Direction of Survey
Line 7:	Use of sewer*
Line 8:	Pipe Material
Line 9:	Pipe Diameter/Height
Line 10:	Pipe Length (on plans)
Line 11:	Start Manhole Number
Line 12:	End Manhole Number
Line 13:	Pipe ID (PSR or MMS #)
Line 14:	Inspection Time/Date

Line items noted with an asterisk (*) are optional depending on the line capacity of the text overlay equipment.

2.22.7 This data must completely match the data entered in the database header information.

2.22.8 The initial text screen shall appear no more than 15 seconds at the beginning of the video footage, and shall appear before the 360 degree pan of the starting manhole.

2.22.9 During the CCTV inspection, the video shall show the following text at all times:

Line Number	Description
Line 1:	City
Line 2:	Street/ Start Manhole Number/ Direction of Inspection/ End Manhole Number
Line 3:	Pipe Material / Pipe Size
Line 4:	Inspection Time/Date/Running Total

2.22.10 During the CCTV inspection, the camera shall stop at all defects and significant observations to ensure a clear and focused view of the pipe condition and shall rotate the camera head at the defect to allow for adequate evaluation at a later time.

2.22.11 All defects and significant observations shall include a text overlay of the recorded observation.

2.22.12 The video recording shall include on-screen observation text for every observation recorded in the database, including AMH, in addition to the text in Section 2.24.9.

2.22.13 The naming of the video file shall consist of the "FROM MANHOLE STATION NUMBER", "TO MANHOLE STATION NUMBER", and the eight digit inspection date, as shown in the following example, or as pre-approved by CSMD:

0+00_3+45_20050101.mp4
(FromMHStation_ToMHStation_YYYYMMDD)

Note: "Manhole Station Number" may consist of survey station numbers as indicated on the design plans.

2.23 Photographs

2.25.1 Digital photographs in JPEG format shall be made of all recorded defect observations. These photographs will be computer generated with the use of the inspection reporting system software.

2.25.2 JPEG images shall be captured at a minimum resolution of 640x480 pixels.

2.25.3 At a minimum, all photographs shall be named consisting of the following descriptions: "FROM MANHOLE STATION NUMBER", "TO MANHOLE STATION NUMBER", eight digit inspection date,

and the defect 'station' location along the pipe. It is in the Contractor's discretion as to additional data information that may be needed in the naming of the files to make each file unique within the file naming constraints of their inspection software.

0+00_3+45_20050101_125_A.jpg
(FromMHStation_ToMHStation_YYYYMMDD_Defect Position_UniqueData)

2.25.4 Any additional information shall be included after the mandatory info specified above. The naming convention shall be consistent throughout the project.

2.25.5 A minimum of TWO photographs of each defect shall be taken, one with a perspective view and one with a close-up view.

2.25.6 ONE photograph is required for each lateral connection looking directly at the connection and each AMH observation from the bottom of the manhole looking up.

2.24 Additional Inspection Procedures

2.26.1 Bulkheads shall be removed along the entire segment of the sewer line from manhole to manhole. Otherwise, the segment is considered incomplete.

2.26.2 A full 360 degree pan of all manholes is required. This video footage shall occur at the beginning of each pipe segment survey inspection from the bottom of the manhole panning up the manhole shaft. The Contractor shall cover the manhole opening to prevent too much light from entering the structure and to ensure a clear and focused view of the manhole interior. In instances when the manhole is the terminating manhole, then the pan shall occur at the end of the pipe segment survey inspection.

2.26.3 Video footage shall be taken centered on the pipe with the water level running horizontally. The camera shall run along the invert of the pipe and not at its side, unless it is passing a point obstacle. If extended driving on the side of the pipe is required, then either the pipe needs a more thorough cleaning or an observation should be noted from the PACP codes describing the nature of the obstacle.

2.26.4 Obstructions may be encountered during the course of the CCTV inspection that prevent the travel of the camera. In instances when obstructions are not passable, the Contractor shall withdraw the equipment and begin a CCTV inspection from the opposite end of the sewer reach.

2.26.5 If a particular line is inspected more than once, then the Contractor shall include all versions of the inspections in the database. The MGO observation shall be used on all inspections except at the first occurrence. The Contractor shall provide an explanation for the additional inspections in the Remarks section.

3. SPECIAL CONDITIONS

EXCESSIVE DEPTH OF FLOW:

3.1 Maximum depth of flow for CCTV inspections shall be 25 percent of the pipe diameter. If the depth of flow is greater, then the CCTV inspection shall be performed during the low flow periods between the hours of 10:00 p.m. to 6:00 a.m.

3.2 The Contractor shall pay special attention to all local jurisdiction rules and regulations, especially regarding activities during off-peak hours.

3.3 If the flow is still above 25 percent on the return trip, then the Contractor can use a flow-controlling mechanism (i.e. flow reducer) to control the flow and proceed with the inspection. After the initial screen and AMH observation, the MGO observation shall be used to note the reason for the return to this location and indicate the use of such flow-controlling equipment, in the appropriate box in the section header information screen.

3.4 The Contractor shall include the original inspection in the final submittal even with high flow conditions.

3.5 If the Contractor encounters a surcharging manhole (whereas the flow at the manhole is at least 50 percent of the sewer pipe diameter), then the Contractor shall immediately notify the Public Works Radio Dispatch at (800) 675-HELP.

4. SUBMITTALS AND DELIVERABLES AND REVIEW

SUBMITTAL:

4.1 The Submittal will consist of:

4.1.1 A hard drive or DVD(s) containing the database, video, and photo files.

4.1.2 A printed Report in a hardcover white clear view 3-ring binder labeled as described in Section 4.4, containing the following information:

4.1.2.1 Footage calibration report for each camera used.

4.1.2.2 PACP Certificate copies of all operators.

4.1.2.3 Summary table of all pipeline segments inspected with the following fields in the order listed:

Column 1: Date of Inspection
Column 2: Start Manhole
Column 3: Stop Manhole
Column 4: Total Pipe Length (per as-built plan)
Column 5: Televised Length
Column 6: Quick Maintenance Rating (per PACP)
Column 7: Quick Structure Rating (per PACP)
Column 8: Section Number

(*NOTE: The table shall be sorted by StartManhole)

4.1.2.4 An observation table of all pipeline segments inspected with the following fields in the order listed:

Column 1: Section Number
Column 2: Position of Defect
Column 3: Observation Code (per PACP)
Column 4: Observation Description (per PACP)
Column 5: Structural Grade (per PACP)
Column 6: O&M Grade (per PACP)

(*NOTE: The table shall be sorted by Section Number)

DELIVERABLES:

4.2 As part of the Submittal, the Contractor shall submit all video recordings, image files, and databases on a maximum of 20 DVDs or a rectangular shaped external hard drive with USB 2.0 connection, or similar, as pre-approved by CSMD. If a hard drive is submitted, the submittal shall include the power cord and USB connection cable. The external hard drive and cables will become property of CSMD unless otherwise indicated.

4.3 DVD's or External hard drive(s), binder cover and binder spine label shall include the following information on computer-generated labels:

4.3.1 LACDPW – Sewer Maintenance Division

4.3.2 General Contractor Name and Sub-contractor Name

4.3.3 Project Name (e.g. PC 123456 Tract 15423-02)

4.3.4 Start Date of CCTV Inspections (e.g. MM/DD/YYYY)

4.3.5 Finish Date of CCTV Inspections (e.g. MM/DD/YYYY)

4.4 All files included as part of the deliverables shall be contained within one single folder on the DVD or hard drive and labeled with the project name, and the date as:

PC45123_52369-02_AcceptanceReview_20071220_1

(PrivateContractNumber_TractNumber_AcceptanceReview_ YYYYMMDD _Submittal#)

REVIEW:

4.5 The video recordings, photographs, and data shall be reviewed by CSMD for focus, lighting, clarity of view, and technical quality.

4.6 Videos or photographs recorded while a camera has flipped over in the process of traveling or the viewing of laterals, obstructions, or defects are blocked by cables, skids or other equipment will not be accepted.

4.7 Shape, focus, proper lighting, and clear, distortion-free viewing during the camera operations shall be maintained. Failure to maintain these conditions will result in the rejection of the video and/or photographs by the CSMD.

4.8 Videos or photographs recorded showing steam, inadequate lighting, or other poor image quality will be cause for rejection by CSMD.

4.9 Any reach of sewer where recording quality, inspection, and/or report is not acceptable according to this Technical Specifications to CSMD shall be re-televised, or data modified.

5. ADDITIONAL RESPONSIBILITIES OF THE CONTRACTOR

5.1 In the event of any Contractor-related overflow or interruption/backup of customer service, the Contractor shall immediately notify the Public Works Radio Dispatch at (800) 675 – HELP, and shall contain and eliminate the overflow.

5.2 The Contractor shall be responsible for any fines levied by others, reimbursement of any agency incurred costs, damage, cleanup, restoration of flow, and any disruption of service costs to customers as a result of the Contractor's work. This is in addition to any and all costs incurred by the customer.

5.3 The Contractor shall respect the rights of property owners, and not enter upon private property without obtaining permission from the owner of the property.

5.4 For manholes located in easements of private property, the Contractor shall provide the resident with 24-hour advanced notice for easement

access prior to entering the property, unless the resident provides immediate permission.

Typical Inspection Procedure:

1. Display Overlay with Segment details
2. Pan Manhole 360 degrees, from bottom looking up
3. Start inspection from edge of pipe, resetting the footage to zero at the start of pipe inspection.
4. Indicate AMH (Manhole) and MH Number in Remarks to start survey
5. Indicate MWL (Water Level)
6. Indicate MWM (Water Mark) if visible
7. Conduct survey
    a. Record all defects & taps
    b. Take 2 Photos of each defect
        i. Close-up

        ii. Perspective View (looking down the pipe at the defect)

        iii. Take 1 Photo of each tap

8. End Inspection
    a. If the camera can not pass or continue due to:
        i. Water level > 25%
            1. Attempt during low flow period
            2. If flow is high use a flow reducer and inspect
        ii. Roots/Collapsed/Blockage
            1. Abandon Survey
                a. Use MSA Code to indicate Survey Abandoned; indicate in the remarks why survey is abandoned.
                b. Setup Camera at next manhole, and repeat Inspection Procedure toward the original start manhole until:
                    i. camera cannot pass, and end inspection with MSA code
                    ii. If camera is able to make it through, end with AMH code, and include an MGO code to indicate that on the reverse attempt a full inspection was completed
    b. If the camera reaches the end Manhole:
        i. Indicate AMH and MH number in Remarks
        ii. Display Ending Screen Text
        iii. 360 degree Pan of Manhole, if the manhole is the terminal manhole.

Emergency Information:

In the event of any Contractor-related overflow or interruption/backup of customer service, the Contractor shall immediately:

Notify Public Works Radio Dispatch at (800) 675 – HELP or (800) 675 – 4357.
Contain and eliminate the overflow.

File Naming:

Database File Name: PrivateContractNumber_TractNumber_YYYYMMDD_Acceptance Review_Submittal#.mdb

Ex. PC45123_52369-02_20071220_AcceptanceReview_1.mdb

Photo Name(s): FromMHStation_ToMHStation_YYYYMMDD_Defect Position_UniqueData.jpg
Ex. 0+00_3+45_20050101_125_A.jpg

*NOTE: Photographs shall be taken as follows:
2 photographs of each defect &
1 photograph of each lateral connection

Video Name(s): FromMHStation_ToMHStation_YYYYMMDD.mp4
Ex. 0+00_3+45_20050101.mp4

Section Header Data:

Dates: YYYYMMDD (4 digit year, 2 digit month, 2 digit day)

Manhole Names: ##+## (Station Number)
Ex. 12+00

Feet Televised: This distance shall be measured from the exit of the start manhole and the entrance of the finish manhole. (i.e. only the distance of the pipe)

Example Label:

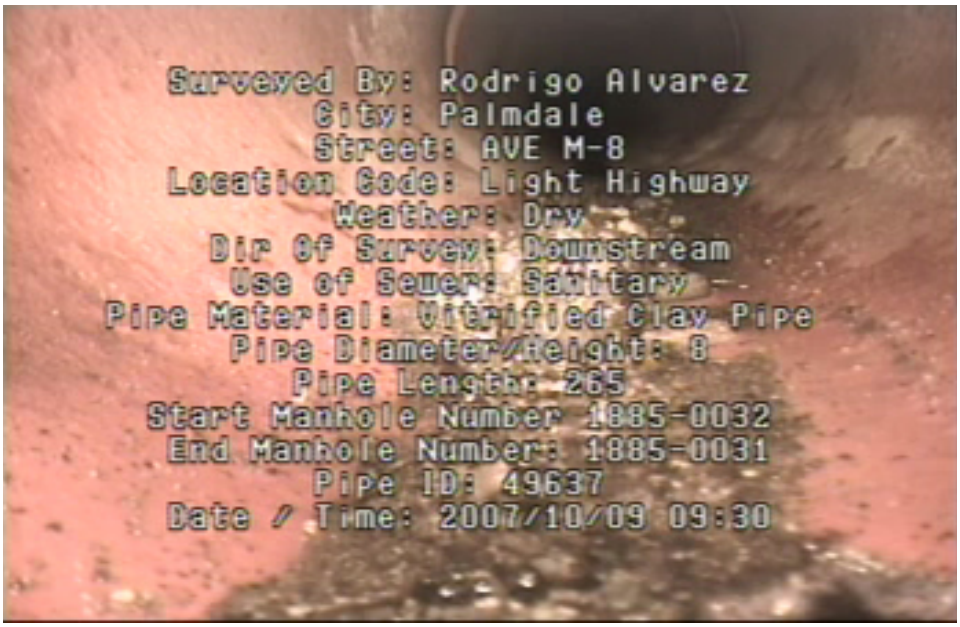
LACDPW – Sewer Maintenance Division
General Contractor and CCTV Co
PC 123456 Tract 15423-02
Start: 01/05/2008
Finish: 02/07/2008

Screen Overlays:

INITIAL TEXT SCREEN:

Include all of the following lines of text in the order listed; if your software/hardware does not allow for 14 lines of text, the lines marked OPTIONAL can be omitted as needed.

Line 1:	Surveyed By
Line 2:	City
Line 3:	Street
Line 4:	Location Code (OPTIONAL)
Line 5:	Weather (OPTIONAL)
Line 6:	Direction of Survey
Line 7:	Use of Sewer (OPTIONAL)
Line 8:	Pipe Material
Line 9:	Pipe Diameter/Height
Line 10:	Pipe Length (Total length provided)
Line 11:	Start Manhole Number
Line 12:	End Manhole Number
Line 13:	Inspection Time/ Date/ Feet TV'd



RUNNING SCREEN TEXT:

During the CCTV inspection, the video shall show the following text at all times:

Line 1:	Date/ Time/ City
Line 2:	Start Manhole Number/ End Manhole Number
Line 3:	Direction of Survey
Line 4:	Street Name
Line 5:	Pipe Diameter/ Pipe Material/ Current Footage

OBSERVATION SCREEN TEXT:

The video shall the display the following screen when an observation is recorded.

Line 1:	Date/ Time/ City
Line 2:	Start Manhole Number/ End Manhole Number
Line 3:	Direction of Survey
Line 4:	Street Name
Line 5:	Observation Code – Observation Text Description
Line 6:	Pipe Diameter/ Pipe Material/ Current Footage

PACP Codes:

AMH – All inspections shall start with AMH, or other appropriate code for access point. (Refer to PACP Reference manual pg 7-13)

MSA – All inspections where a segment is abandoned due to a blockage, obstruction, or collapsed sewer shall end with this code, and a reverse inspection shall be attempted. (Refer to PACP Reference manual pg 1-4, 8-2, and 8-7)

MGO – This code shall be used when additional remarks are necessary…such as, reverse inspection, re-inspected during low flow, segment excused by DPW. Also, any defects in Manholes, such as a hole in the trough shall be recorded as an MGO.

MWL – This code shall be used at the beginning of each survey to indicate the water level, and shall be used throughout the survey if the water level changes by 5% or more. (Refer to PACP Reference manual pg 8-2)

MWM – This code shall be used when there is an obvious mark on the side of the sewer line, where the water regularly reaches. (Refer to PACP Reference manual pg 8-2)

RBL – This code shall be used when roots have formed a mass and, in doing so, are restricting the flow. This code should be used when the cross sectional area lost is greater than 50% INSIDE the service pipe connection ONLY(i.e. lateral or tap connections) (Refer to PACP Reference manual pg 6-7)

RBC – This code shall be used when roots have formed a mass and, in doing so, are restricting the flow. This code should be used when the cross sectional area lost is greater than 50% and the roots extend OUTSIDE the service pipe connection and into the main sewer pipe. (Refer to PACP Reference manual pg 6-7)

RBB – This code shall be used when roots have formed a mass and, in doing so, are restricting the flow. This code should be used when the cross sectional area lost is greater than 50% and the roots are ENTIRELY WITHIN the main sewer pipe. (Refer to PACP Reference manual pg 6-7)

Example Summary Table:

Los Angeles County, 1000 S. Fremont Avenue, Alhambra CA, 91803, Tel: , Fax: (626) 300-3365 // WinCan Specs Demo.mdb

	Date	Start MH	Stop MH	Total Pipe Length	Tot. Length	Quick maint rate	Quick struct rate	Section No
1	06/17/2005	0+00	3+15	315	314.01	0000	1100	1
2	06/17/2005	3+15	6+40	325	322.02	2211	3100	2
3	06/17/2005	6+40	9+40	300	301.01	0000	0000	3
4	06/17/2005	9+40	12+00	320	320.99	1300	1300	4

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Example Observation Table:

Los Angeles County, 1000 S. Fremont Avenue, Alhambra CA, 91803, Tel: , Fax: (626) 300-3365 // WinCan Specs Demo.mdb

	Section No	Position	OC	Observation	Struct Gr	O+M Grade
1	4	0	AMH	Upstream Manhole, Survey Begins		
2	4	0	MWL	Water Level, 15 % of cross sectional area, from 05 to 07 o´clock		
3	4	22.24	TFA	Tap Factory Made Active, at 10 o´clock, 6", within 8 inch: NO		
4	4	38.47	CM	Crack Multiple, from 10 to 04 o´clock, within 8 inch: YES	3	
5	4	71.32	TFA	Tap Factory Made Active, at 03 o´clock, 6", within 8 inch: NO		
6	4	114.58	TFA	Tap Factory Made Active, at 03 o´clock, 6", within 8 inch: NO		
7	4	137.54	TFA	Tap Factory Made Active, at 03 o´clock, 6", within 8 inch: NO		
8	4	245.94	AMH	Downstream Manhole, Survey Ends		
9	5	0	AMH	Upstream Manhole, Survey Begins		
10	5	0	MWL	Water Level, 15 % of cross sectional area, from 05 to 07 o´clock		
11	5	10.01	TFA	Tap Factory Made Active, at 03 o´clock, 6", within 8 inch: NO		
12	5	51.02	MWM	Water Mark 10 % of cross sectional area		2
13	5	100.7	TFA	Tap Factory Made Active, at 03 o´clock, 6", within 8 inch: NO		
14	5	115.94	AMH	Downstream Manhole, Survey Ends		

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Submittal Check List:

The following items shall be included in your submittal to CSMD before it will be processed for the Acceptance of Sewer into the CSMD.

_____ DVD(s) (maximum 20) or a rectangular shaped hard drive or containing:

_____ WinCan database file (mdb),
_____ Video files (mp4), and
_____ Photo files (jpg).

(NOTE: VHS video tapes will not be accepted)

_____ A hardcover white clear view 3-ring binder labeled as described in Section 4.3 including the following items:

_____ Footage calibration report for each CCTV camera used.

_____ PACP Certificate copies of all operators.

_____ Summary table of all pipeline segments inspected with the following fields in the order listed:

Column 1: Date of Inspection
Column 2: Start Manhole
Column 3: Stop Manhole
Column 4: Total Pipe Length (per as-built plan)
Column 5: Feet TV'd Televised Length
Column 6: Quick Maintenance Rating (per PACP)
Column 7: Quick Structure Rating (per PACP)
Column 8: Section Number

(*NOTE: The table shall be sorted by Start Manhole)

_____ An observation table of all pipeline segments inspected with the following fields in the order listed:

Column 1: Section Number
Column 2: Position of Defect
Column 3: Observation Code (per PACP)
Column 4: Observation Description (per PACP)
Column 5: Structural Grade (per PACP)
Column 6: O&M Grade (per PACP)

(*NOTE: The table shall be sorted by Section Number)