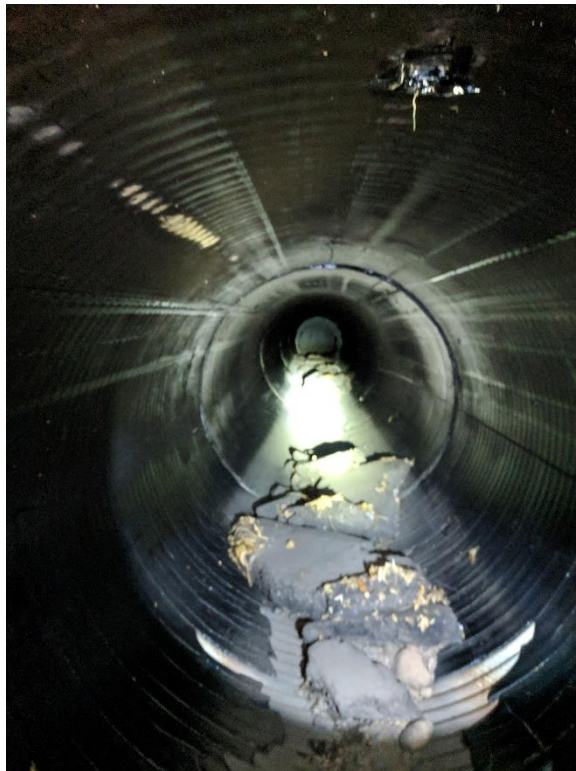
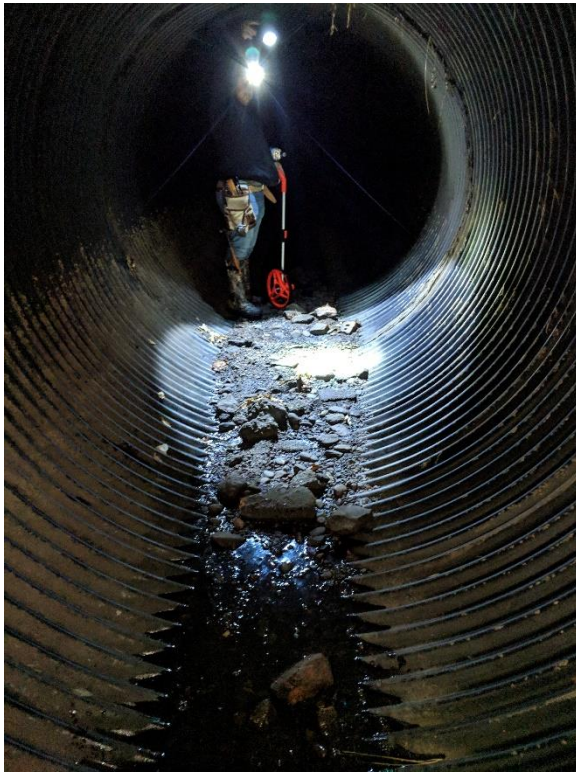


# South Englewood Storm Sewer Condition Assessment



*Prepared for*  
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*Prepared by*  
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**Table of Contents**

|   |    |
|---|----|
| Abbreviations and Acronyms.....                     | i  |
| Introduction, Purpose, and Project Background ..... | 1  |
| System Definition.....                              | 1  |
| Condition Assessment Approach .....                 | 3  |
| Desktop Investigations.....                         | 3  |
| Field Investigations.....                           | 3  |
| Storm Sewer Condition .....                         | 4  |
| Conclusions.....                                    | 10 |
| Recommendations.....                                | 11 |
| Limitations of Report.....                          | 12 |

**Table of Contents**

|   |    |
|---|----|
| Abbreviations and Acronyms.....                     | i  |
| Introduction, Purpose, and Project Background ..... | 1  |
| System Definition.....                              | 1  |
| Condition Assessment Approach .....                 | 3  |
| Desktop Investigations.....                         | 3  |
| Field Investigations.....                           | 3  |
| Storm Sewer Condition .....                         | 4  |
| Conclusions.....                                    | 10 |
| Recommendations.....                                | 11 |
| Limitations of Report.....                          | 13 |

## **Abbreviations and Acronyms**

|          |  |   |
|----------|--|---|
| Ave      |  | Avenue                                    |
| City     |  | City of Englewood                         |
| CMP      |  | Corrugated Metal Pipe                     |
| ft       |  | Feet                                      |
| HDCCTV   |  | High-Definition Closed Circuit Television |
| in       |  | Inch or inches                            |
| Lf or LF |  | Linear feet                               |
| LiDAR    |  | Light Detecting and Ranging               |
| MH       |  | Manhole                                   |
| RCP      |  | Reinforced Concrete Pipe                  |
| Renewal  |  | Replacement or rehabilitation             |
| S        |  | South                                     |
| Sed      |  | Sedimentation                             |
| St       |  | Street                                    |
| Sta      |  | Station                                   |
| System   |  | South Englewood Storm Sewer               |
| W        |  | West                                      |

## Introduction, Purpose, and Project Background

This report presents information gathered, discusses inspection and assessment methodologies followed and conclusions and recommendations presented by Calibre Engineering (Calibre) regarding the general condition of portions of the City of Englewood's (City) South Englewood Storm Sewer (system). The purpose of this project phase is to (a) review desktop data, (b) perform an internal inspection of the selected storm sewer assets, and (c) determine what additional steps may be required to more thoroughly understand actual condition of the system. Once this information was gathered and analyzed, recommendations regarding pipeline renewal (rehabilitation or replacement) were developed and are presented herein.

## System Definition

The portion of the system investigated includes pipe segments beginning at the South Platte River and extending to Rotolo Park. The alignment evaluated was defined by the City and generally runs east from the river approximately 3,000 feet (ft) along W. Oxford Avenue to Navajo Street (Line 1), then turns south on Navajo Street for approximately 1,300 ft, then follows W. Quincy Avenue for approximately 250 ft, before entering an easement and running approximately 640 ft to a cul-de-sac in W. Radcliffe Drive. The line continues along W. Radcliffe Drive to S. Jason Street and then on to Rotolo Park (Line 2). See Figure 1 attached in Appendix A which shows the alignment investigated, the assigned segment numbers (Line 1 -Segments 1 – 7 and Line 2 – Segments 12 – 22), and the four sections of pipe that have been reconstructed in recent years.

Pipeline segments within the portion of the system investigated, were generally defined as "lengths of pipe from access point to access point (manhole to manhole) that have the same diameter." However, due to system modifications as a result of improvements to Santa Fe Drive, construction of Light Rail, and pipeline reconstruction, definitions of segments along Line 1 vary from access point to access point. Therefore; determining the exact length of each pipe segment is beyond the scope of this initial report; field measurements, whether by traditional surveying or robotic methods, will be completed during the design phase of this project.

The following table illustrates the segment definitions used for condition assessment purposes. In addition, Appendix B contains all of the field notes and photographs gathered during man-entry inspections.

**Table 1 – Segment Descriptions**

| <b>Segment Designation</b>  | <b>Material</b> | <b>*Begin Segment</b> | <b>*End Segment</b> | <b>Diameter (in)</b> | <b>Length (ft)</b> |
|---|-----------------|-----------------------|---------------------|----------------------|--------------------|
| <b>LINE 1: W. Oxford Avenue – S. Platte River to Navajo Street</b>                      |                 |                       |                     |                      |                    |
| 1   | CMP             | S. Platte River       | MH R-1              | 92                   | 72                 |
| 2   | CMP             | MH R-1                | MH R-2              | 92                   | 470                |
| 3   | CMP             | MH R-2                | MH R-3              | 92                   | 575                |
| 4   | CMP             | MH R-3                | MH R-4              | 92                   | 625                |
| 5   | CMP             | MH R-4                | Increaser           | 92                   | 175                |
| 6   | RCP / CMP       | Increaser             | Begin Realignment   | 78                   | 425                |
| 7   | CMP / RCP       | Begin Realignment     | MH R-6              | 78                   | 1808               |
| <b>LINE 2: Navajo St, Quincy Ave, Easement, W. Radcliffe Ave, Jason St, Rotolo Park</b> |                 |                       |                     |                      |                    |
| 12  | CMP             | MH R-6                | MH R-201            | 84                   | 421                |
| 13  | CMP             | MH R-201              | MH R-202            | 84                   | 453                |
| 14  | CMP             | MH R-202              | Begin jacked Pipe   | 84                   | 410                |
| 15  | RCP             | Begin jacked pipe     | End jacked pipe     | 66                   | 24                 |
| 16  | CMP             | End jacked pipe       | MH R-203            | 84                   | 146                |
| 17  | CMP             | MH R-203              | Reducer             | 84                   | 512                |
| 18  | CMP             | Reducer               | MH R-204            | 76                   | 430                |
| 19  | CMP             | MH R-204              | MH R-206            | 76                   | 390                |
| 20  | RCP             | MH R-206              | MH R-207            | 60                   | 510                |
| 21  | RCP             | MH R-207              | Transition          | 60                   | 405                |
| 22  | CMP             | Transition            | Rotolo Park         | 72 X 44              | 93                 |

\*Manhole references are relative to the 1973 Sellards and Grigg as-built drawings.

All CMP Segments inspected are protected with a spray applied corrosion barrier most likely applied prior to installation of the pipe which, where visible, appears to be in good condition.

## Condition Assessment Approach

The condition assessment approach in this phase of the project included a desktop review of record information, discussions with City staff, and initial internal point-to-point visual inspections of the sewer to gather information regarding the current condition of the portion of the system investigated.

## Desktop Review

The desktop review included examination of:

- As-Built drawings of the original sewer systems prepared by Sellards and Grigg, Inc, - 1973
- System modifications completed as part of the realignment Santa Fe Drive, prepared by the State of Colorado, State Department of Highways – 1992
- System modifications including replacement of:
  - 72 LF of 78-inch diameter reinforced concrete pipe (RCP) just south of W Oxford Avenue and west of Navajo Street
  - 76 LF of 78-inch diameter RCP south of W Oxford and west of Navajo Street
  - 36 LF of 78-inch diameter RCP along W Oxford Avenue and west of Santa Fe Drive
  - 56 LF of 78-inch diameter RCP along W Oxford Avenue and west of Santa Fe Drive
- The 1999 Storm Sewer Inventory Report prepared by Muller Engineering Company, Inc.
- And conducting a series of interviews with City staff, the Director of Utilities and the Distribution and Collection Superintendent, to gain an understanding of the system layout, history, repair history and maintenance activities (routine and emergency)

## Field Investigations

The first 7266-foot length of the storm sewer, Segment 1 through 7 and Segment 12 through 20, were examined by man-entry point-to-point inspection on November 11, 2018. City staff provided video of Segments 21 and 22 (approximately 498 feet) for use in system evaluation. The field inspections were documented with field notes, photographs, and video records.



*Field Notes* – field notes, attached in Appendix B, document corrosion, deformation, invert deterioration, and/or joint and seam damage in each pipe segment. Location of *corroded* areas were noted as being:

- *Invert* - approximately 12 – 18 inches each side of the bottom centerline
- *Invert to the spring line* – from the outer limits of the invert to the 3- and 9 - o'clock positions on the pipe
- *Spring line to the crown* – from the 3- and 9- o'clock positions on the pipe to the limits of the crown
- *Crown* – approximately 12 – 18 inches each side of the top centerline.

Whereas *deformation* and *invert deterioration* were rated as either Major, Medium, or Minor depending on the observed severity. *Joint damage* was designated as separated, misaligned, faulted, or partially opened. Other than a few isolated areas of corrosion, all confined to pipe inverts and two incidences of joint damage, the pipe segments appear to be in very good condition.

## Storm Sewer Condition

Other than the segments and sections noted below, the condition of the storm sewer segments inspected are in good condition. Our field inspectors noted a total of nine (9) segments where there was observed anomalies such as corrosion, deformation, invert deterioration or joint separation. However, they were neither significant nor critical in terms of the segment's structural integrity or hydraulic performance. In these segments there was no appreciable corrosion, deformation, invert deterioration or joint separation noted.

Segments 1 through 7 generally run along W. Oxford Avenue from the South Platte River to Navajo Street. Segments 12 through 22 run along various alignments including Navajo Street, Quincy Avenue, W Radcliffe Avenue, and Jason Street, and terminating in Rotolo Park. NOTE: Segments 8 – 11 were not included in this study.

The following summarizes observations of the nine segments and the noteworthy defects associated with them. Photologs are documented in Appendix B.

*Segment 1* – Minor coating damage approximately 20 feet in length was noted along the invert at approximate station 101+00 (Stationing is relative to the 1973 Sellards and Grigg as-built drawings).





*Segment 2* – No corrosion, deformation, or invert deterioration was noted; however, there a partially opened joint at approximate station 101+58 (stationing is relative to the 1973 Sellards and Grigg as-built drawings) and there is a significant amount of sedimentation (sand and gravel) in the invert.

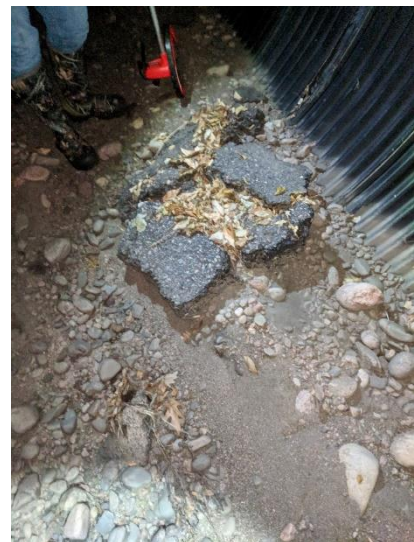
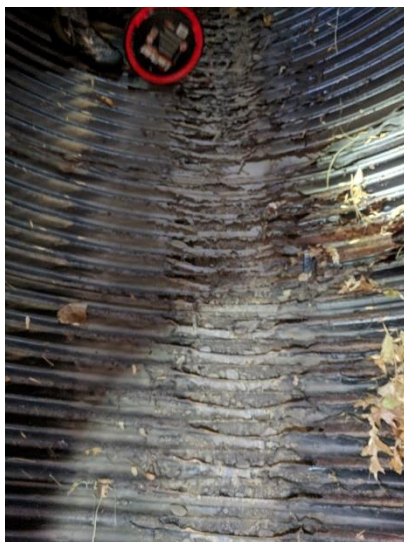


*Segment 3* – No corrosion, deformation, invert deterioration, or joint damage was noted; however, sedimentation deposits become extremely heavy and were noted as follows: Sta 108+90 Sed 17"; Sta 109+57 Sed 21"; Sta 110+25 Sed 22"; Sta 111+13 Sed 31"; Sta 111+75 Sed 32" (stationing is relative to the 1973 Sellards and Grigg as-built drawings)



*It is more than likely that the invert is severely deteriorated beneath the sedimentation*

*Segment 4* – No corrosion, deformation, or joint damage was noted; however, severe invert deterioration was noted at station 118+00 and heavy sedimentation deposits and collections of debris (asphalt) were noted as follows: Sta 111+75 Sed 32"; Sta 112+21 Sed 31"; Sta 112+98 Sed 23"; Sta 114+10 Asphalt, Sed 14"; Sta 116+33 Asphalt; Sta 117+32 End asphalt deposition. (stationing is relative to the 1973 Sellards and Grigg as-built drawings).



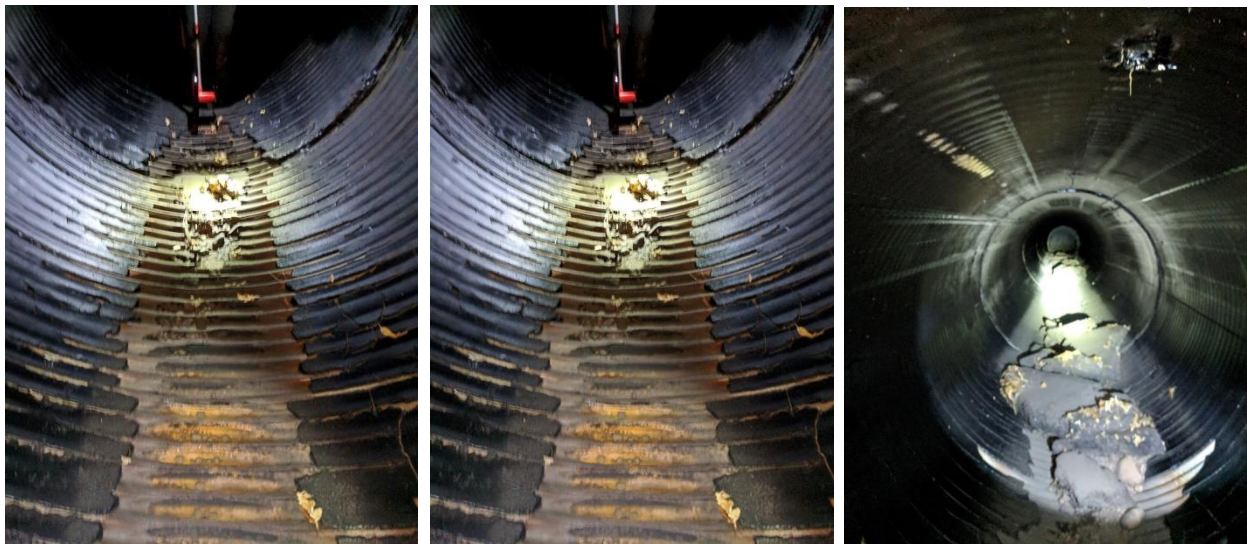
*It is more than likely that the invert is severely deteriorated beneath the sedimentation*



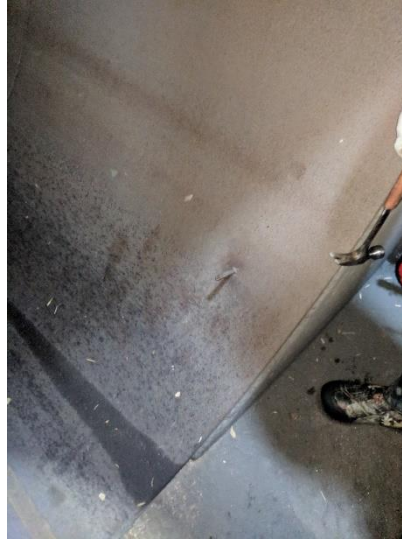
*Segment 5* - No corrosion, deformation, or joint damage was noted; however, severe invert deterioration was noted from station 118+63 to station 119+37. (Stationing is relative to the 1973 Sellards and Grigg as-built drawings).



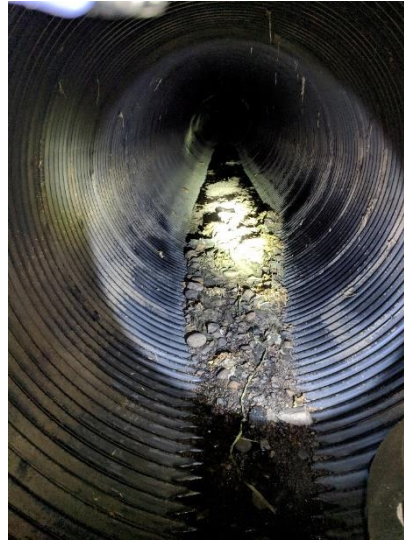
*Segment 6* - No corrosion, deformation, or joint damage was noted; however, severe invert deterioration was noted along most of the CMP sections of pipe. Some isolated areas of debris deposits were noted; asphalt.



*Segment 7* – This segment includes portions of the pipeline that were realigned as part of the Santa Fe project; therefore, stationing information varies from the Sellards and Grigg drawings and is not offered as part of the evaluation. No corrosion, deformation, invert deterioration, or joint damage noted.

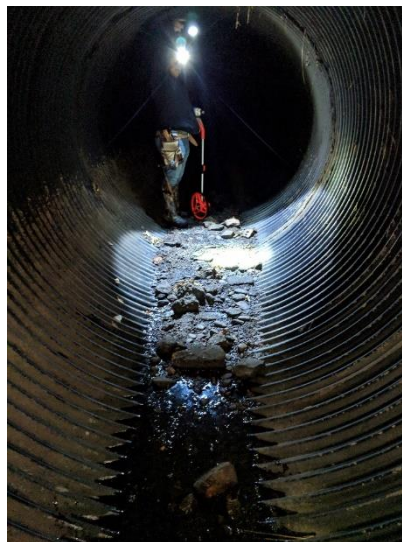


*Segment 12* – This is the first segment along Navajo Street; other than some areas of minor debris collection, no other issues were noted.



**NOTE:** *Segments 13 – 16 and Segments 18 and 20 did not show any appreciable sign of deterioration; therefore, no description is provided herein. These segments are fully documented in the field notes attached in Appendix B.*

*Segment 17* – No corrosion, deformation, invert deterioration, or joint damage was noted; however, there was some areas of debris deposits from station 215+14 to 217+67. (Stationing is relative to the 1973 Sellards and Grigg as-built drawings).





*Segment 19* - No corrosion, deformation, invert deterioration, or joint damage was noted; however, there was some areas of minor debris deposits from station 226+29 to 226+43. *(Stationing is relative to the 1973 Sellards and Grigg as-built drawings).*

Segment 20 was the last segment inspected by man-entry; city staff provided video of segments 21 and 22 for evaluation.

*Segment 21 and Segment 22* – based on review of the video records provide by City staff, these pipe segments both have small areas of debris collection and some areas of significant invert deterioration. This preliminary inspection suggests that Segment 22 has a fully deteriorated invert over most of the 93-foot length.

## Conclusions

*Structural and Bedding Deficiency Considerations* - Based on the information evaluated, the pipe segments investigated appear to be in good general condition. Other than isolated sections of invert deterioration, joint damage, and areas of moderate debris and sedimentation, there are not areas of wide-spread corrosion, joint separation, deflection or ovality (deformation). Areas of concern regarding structural issues are locations where the CMP invert is severely deteriorated or completely missing and the bedding has washed out; reference Segment 5 photo above. If not repaired, this situation can first lead to deformation of the pipe, and potentially a sudden failure of the pipeline. Also, the loss of bedding material can lead to migration and creation of larger voids in the soil surrounding the pipe at other locations, further compromising the structural integrity of the entire pipe segment and potentially leading to catastrophic failures such as sink holes *(testing for soil voids was beyond the scope of this study, however there are non-destructive technologies that can be used to locate and quantify soil loss.)*

*Hydraulic Considerations* - Sedimentation deposits in Segments 2 and 3 are most likely the result of high-water levels from the South Platte River. Staff reported that, during storm events, the river has risen to just below the W. Oxford Avenue bridge. Therefore, the high-water elevation was well above the grate covered storm sewer outlet. It is highly likely that water, under these higher-intensity storm events, backs up several hundred feet into the storm sewer system until the system empties after the river recedes. During this time when the system is backed up and flow velocities are very low, sand, gravel, and other suspended material settle out of the water and are deposited within the impacted pipe segments. Storms of lesser intensity, however, appear to be insufficient in creating enough scouring velocities to self-clean this deposited material, particularly where pipe invert gradients are relatively flat. Based on the amount of sedimentation observed, this process has occurred multiple times.

Staff also reported surcharging in the system; occurrences when incoming storm water flow exceeded capacity of the system, resulting in pressurizing the system to the point that manhole lids and inlet grates were dislodged from their seated position. Two factors could be contributing to these events; larger diameter pipelines installed upstream of smaller diameter pipelines and blockages in the system due to debris and sedimentation.

The east end of the system that was investigated, Line 2, begins at a detention facility located in Rotolo Park. Pipe diameters gradually increase from 72 x 44 inches to 84-inches along Navajo Street where it connects to a 78-inch pipe at W. Oxford Avenue (Segment 1). Depending on the amount of flow, it is possible that the rate of storm water that discharges from the 84-inch pipe into the 78-inch pipe is causing a hydraulic bottleneck and contributing to surcharging. As the pipeline progress along W. Oxford Ave toward the river, the diameter increases from 78-inches to 92-inches. However, the 78-inch segments are relatively long (approximately 2,000 feet), increasing the likelihood for surcharging and other hydraulic bottlenecks.

In addition, the 78-inch segments along W. Oxford Ave are immediately followed by 92-inch segments that currently contain significant quantities of debris and sedimentation; specifically Segments 2 and 3, in which sedimentation consumes approximately 30 percent of the pipe diameter. Downstream pipelines with smaller diameters than upstream pipelines, coupled with excessive debris and sedimentation are likely contributing to poor hydraulic conditions in this portion of the system.

### Recommendations

Condition assessment efforts generally follow a phased approach, beginning with desktop reviews and initial field investigations, followed by development of additional steps and techniques necessary to fully define a facilities actual condition. Once desktop reviews and initial field inspections are complete, subsequent phases typically include cleaning the system and, if necessary, utilizing advanced technology to gather more in-depth information in critical pipe segments (high risk of failure combined with a high consequence of failure). Based on completion of the desktop review and initial field investigations for portions of the South Englewood Storm Sewer system, we recommend the following subsequent steps for project completion:

*Pipe Cleaning* – all debris and sedimentation should be removed from the pipe segments. This will enhance hydraulic capabilities and will uncover pipe sections currently buried beneath as much as 32-inches of sedimentation; allowing for a thorough visual inspection of currently buried inverts. Cleaning areas with minor debris collections will be relatively



straightforward; however, removing sedimentation in Segments 2 and 3 will likely require more labor-intensive removal strategies.

*Acoustic Assessment of Soil Instability* – the use of acoustic assessment equipment to locate and quantify soil voids is recommended. Suspect locations would be in areas where bedding may have been displaced due to invert corrosion. It also will provide information regarding the size and volume of soil voids.

*Mapping* – the pipe assets should be accurately mapped using tractor mounted high-definition closed circuit television (HDCCTV), 2-D laser and LiDar sensors. This technology can be used to accurately measure lengths of pipe segments and corroded inverts giving quantifiable data for use in preparation of pipe renewal bid documents.

*Phase II Condition Assessment* – technology noted above and additional field data collected would then be used to finalize the condition assessment of the pipe segments and provide critical information for the design-and-construction phases of the project.

*Pipeline Renewal Design and Bidding Package* – the third and final phase includes preparation of pipe renewal design and bid documents addressing issues uncovered during the condition assessment phase. Other than isolated joint damage, the structural deficiencies (severe corrosion) noted, are confined to pipe inverts. From a structural standpoint there appears to be no need to rehabilitate the entire diameter of any given pipe segment. *This may change upon evaluation of additional information.*

Rehabilitation may be limited to repair of inverts only, in which case, applicable invert rehabilitation methods would include:

- Pressure grouting voids beneath the corroded invert and troweling in a flowable lean concrete to reconstruct the invert
- Pressure grout voids beneath the corroded invert, lay a concrete cloth (Concrete Canvas) over the length of corroded invert, and fasten the cloth to the exiting culvert walls with stainless steel bolts or by applying a layer of spray applied epoxy or cement mortar lining material. <https://www.youtube.com/watch?v=JUiv67WkqCY>

However, considering the hydraulic deficiencies outlined above, an alternative option could be to simply replace the 78-inch pipe west of Santa Fe with 92-inch diameter pipe.

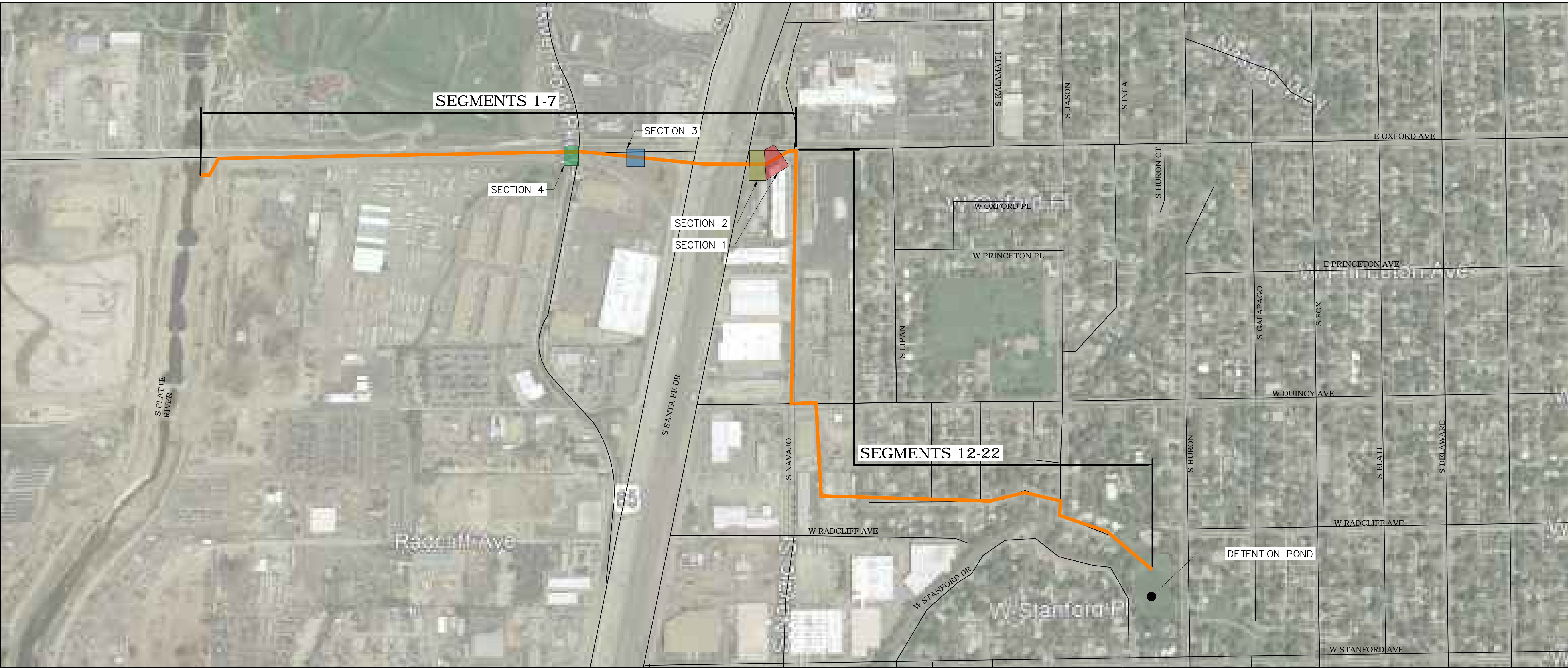
Information from the advanced inspection phase may determine which option is ultimately recommended for asset stability, longevity, and cost-effectiveness.

### **Limitations of Report**

The statements, conclusions, and recommendations offered in this report are based on information gathered as part of a desktop review and initial field investigations. Additional investigations are required to fully understand the condition of the system evaluated.

# Appendix A

## Figure 1 – Storm Sewer Alignment and Segments



- SECTION 1: 72 LF OF 78" RCP
- SECTION 2: 76 LF OF 78" RCP
- SECTION 3: 56 LF OF 78" RCP
- SECTION 4: 56 LF OF 92" RCP

FIGURE 1: STORM SEWER  
ALIGNMENT AND SEGMENTS  
SCALE: N.T.S.

PATH: P:\ENGLEWOOD OSP\CADD\EXHIBITS\FIGURE1.DWG  
PLOTTED BY: JESSICA ALLEN PLOT DATE: 12/29/2018 11:17 AM  
XREFS:

| DATE | REVISION | DESCRIPTION |
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| Drawing Name | Figure1.dwg       |
| Job Number   | ENGLEWOOD OSP     |
| Prepared For | CITY OF ENGLEWOOD |

|          |         |         |
|----------|---------|---------|
| Designer | Drafter | Checked |
| MM       | JNA     | MM      |



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Construction Management Civil Engineering Surveying

CITY OF ENGLEWOOD OSP

SITE EXHIBIT

STORM ALIGNMENT AND SECTIONS



Sheet

F1

1 of 1

Date

28 December 2018

# Appendix B

## Field Notes and Photographs

Date: 11-Nov-18

Inspector: Middleton / Moore

Weather:

| Segment                      | Diameter (in) | Sta                           | Sta                         | Length (ft) | Notes   |
|------------------------------|---------------|-------------------------------|-----------------------------|-------------|---|
| LINE 1 to Navajo Street      |               |                               |                             |             |   |
| 1                            | 92            | 100+58                        | 101+30 MH R-1               | 72          |   |
| 2                            | 92            | 101+30 MH R-1                 | 106+00 MH R-2               | 470         |   |
| 3                            | 92            | 106+00 MH R-2                 | 111+75 MH R-3               | 575         |   |
| 4                            | 92            | 111+75 MH R-3                 | 118+00 MH R-4               | 625         |   |
| 5                            | 92            | 118+00 MH R-4                 | 119+75 Increaser            | 175         |   |
| 6                            | 78            | 119+75 Increaser              | 122+20 Begin<br>Realignment | 245         |   |
| 7                            | 78            | 122+20 Begin<br>Realignment   | 140+28 MH R-6               | 1808        |   |
| LINE 2 Oxford to Rotolo Park |               |                               |                             |             |   |
| 12                           | 84            | 200+04 MH R-6<br>Junction Box | 204+25 MH R-201             | 421         |   |
| 13                           | 84            | 204+25 MH R-201               | 208+78 MH R-202             | 453         |   |
| 14                           | 84            | 208+78 MH R-202               | 212+88 Begin<br>Jacked Pipe | 410         |   |
| 15                           | 66            | 212+88 Begin<br>Jacked Pipe   | 213+12 End Jacked<br>Pipe   | 24          |   |
| 16                           | 84            | 213+12 End Jacked<br>Pipe     | 214+58 MH R-203             | 146         |   |
| 17                           | 84            | 214+58 MH R-203               | 219+70 MH R-204             | 512         |   |
| 18                           | 76            | 219+70 Reducer                | 224+00 MH R-204             | 430         |   |
| 19                           | 76            | 224+00 MH R-204               | 227+90 MH R-206             | 390         |   |
| 20                           | 60            | 227+90 MH R-206               | 233+00 MH R-207             | 510         |   |
| 21                           | 60            | 233+00 MH R-207               | 237+05 Transition           | 405         | DID NOT INSPECT - VIDEO FROM 4330 JASON TO ROTOLO |
| 22                           | 72 x 44       | 237+05 Transition             | 237+98                      | 93          | Rotolo Park                                       |

Storm Drain Condition Assessment  
Field Data Log

Segment 1  
Line 1

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter92in.

Station100+60

Length70ft.

Station101+30

| Corrosion            |             |              |   |
|----------------------|-------------|--------------|---|
| Location             | Approx. Sta | Rating 1 - 3 | Notes   |
| Invert to Springline |             |              | No corrosion noted - CMP in excellent condition |
| Springline to Crown  |             |              | No corrosion noted - CMP in excellent condition |
| Crown                |             |              | No corrosion noted - CMP in excellent condition |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |   |
|----------------------|-------------|--------------|---|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                                     |
| Invert               | 101+00      | 3            | Coating damaged for approximately 20 feet |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                                    |
|------------------|-------------|--------------|------------------------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes                              |
| Joints and Seams | 101+00      | 1            | Slight separation; bedding exposed |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 2  
Line 1

Client: City of Englewood, Colorado  
Project: South Englewood Storm Drain Condition Assessment  
Date: 11/11/2018

Material: CMP  
Diameter: 92 in.  
Station: 101+30  
Length: 470 ft. Station: 106+00

| Corrosion            |             |              |  |
|----------------------|-------------|--------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes  |
| Invert to Springline | Sta 103+65  |              | No corrosion noted - Invert covered with sedimentation (Approx 10" deep) |
| Springline to Crown  |             |              | No corrosion noted - CMP in excellent condition                          |
| Crown                |             |              | No corrosion noted - CMP in excellent condition                          |



| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |
|----------------------|-------------|--------------|----------------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |
| Invert to Springline |             |              | No deformation noted |  |
| Springline to Crown  |             |              | No deformation noted |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |   |
|----------------------|-------------|--------------|---|
| Location             | Approx. Sta | Rating 1 - 3 | Notes   |
| Invert               | Sta 103+65  |              | No deterioration noted - sedimenttion average 10" |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                                |
|------------------|-------------|--------------|--------------------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes                          |
| Joints and Seams | 101+58      | 4            | Sta 101+58 - slight separation |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Storm Drain Condition Assessment  
Field Data Log

Segment 3  
Line 1

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter92in.

Station106+00

Length575ft.

Station111+75

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |   |
|----------------------|-------------|--------------|---|
| Location             | Approx. Sta | Rating 1 - 3 | Notes   |
| Invert               |             |              | No deterioration noted;<br>Sta 108+90 Sed 17"; Sta 109+57 Sed 21"; Sta 110+25 Sed 22"; Sta 111+13 Sed 31"; Sta 111+75 Sed 32" |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 4  
Line 1

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

Material: CMP

Diameter: 92 in.

Station: 111+75

Length: 625 ft.

Station: 118+00

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |
|----------------------|-------------|--------------|----------------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |
| Invert to Springline |             |              | No deformation noted |  |
| Springline to Crown  |             |              | No deformation noted |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |                          |              |   |
|----------------------|--------------------------|--------------|---|
| Location             | Approx. Sta              | Rating 1 - 3 | Notes   |
| Invert               | Sta 117+32 to Sta 118+00 | 1            | Severe invert deterioration<br>Sta 111+75 Sed 32"; Sta 112+21 Sed 31";<br>Sta 112+98 Sed 23"; Sta 114+10 Asphalt, Sed 14";<br>Sta 116+33 Asphalt; Sta 117+32 End asphalt deposit,<br>Sta 118+00 Invert deterioration severe |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 5  
Line 1

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter92in.

Station118+00

Length175ft.

Station119+75

| Corrosion            |                  |              |                         |
|----------------------|------------------|--------------|-------------------------|
| Location             | Approx. Sta      | Rating 1 - 3 | Notes                   |
| Invert to Springline | 118+63 to 119+37 | 1            | Severe invert corrosion |
| Springline to Crown  |                  |              | No corrosion noted      |
| Crown                |                  |              | No corrosion noted      |



| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert to Springline |             |              |       |  |  |
| Springline to Crown  |             |              |       |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |                  |              |  |
|----------------------|------------------|--------------|--|
| Location             | Approx. Sta      | Rating 1 - 3 | Notes                                    |
| Invert               | 118+63 to 119+37 | 1            | Severe invert corrosion; bedding exposed |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 6  
Line 1

Client: City of Englewood, Colorado  
Project: South Englewood Storm Drain Condition Assessment  
Date: 11/11/2018

Material: CMP / RCP  
Diameter: 78 in.  
Station: 119+75  
Length: 245 ft. Station: 122+20

| Corrosion            |             |              |  |
|----------------------|-------------|--------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes  |
| Invert to Springline | 119+75      |              | No corrosion noted<br>Transition missing grout |
| Springline to Crown  |             |              | No corrosion noted                             |
| Crown                |             |              | No corrosion noted                             |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |  |
|----------------------|-------------|--------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes  |
| Invert               |             |              | Heavy invert corrosion noted, isolates areas of debris in CMP sections |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) joint |
| 2                             | Misaligned joint       |
| 3                             | Faulted joint          |
| 4                             | Partially opened       |





Storm Drain Condition Assessment  
Field Data Log

Segment 7  
Line 1

Client: City of Englewood, Colorado  
Project: South Englewood Storm Drain Condition Assessment  
Date: 11/11/2018

Material: CMP  
Diameter: 78 in.  
Station: Estimated 122+20  
Length: 1,808 ft. Station: Estimated 140+28

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |                        |
|----------------------|-------------|--------------|------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                  |
| Invert               |             |              | No deterioration noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) joint |
| 2                             | Misaligned joint       |
| 3                             | Faulted joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 12  
Line 2

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter84in.

Station200+04

Length421ft.

Station204+25

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

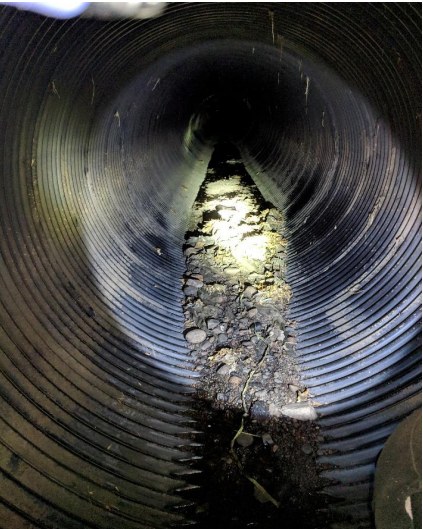
| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |                        |
|----------------------|-------------|--------------|------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                  |
| Invert               |             |              | No deterioration noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |





Storm Drain Condition Assessment  
Field Data Log

Segment 13  
Line 2

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

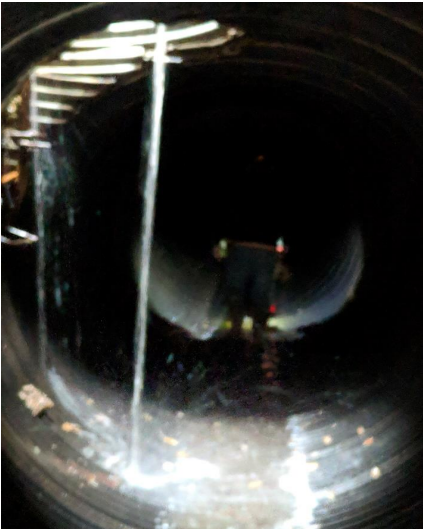
Diameter84in.

Station204+25

Length453ft.

Station208+78

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |



| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |
|----------------------|-------------|--------------|----------------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |
| Invert to Springline |             |              | No deformation noted |  |
| Springline to Crown  |             |              | No deformation noted |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |       |  |
|----------------------|-------------|--------------|-------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |
| Invert               |             |              |       |  |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

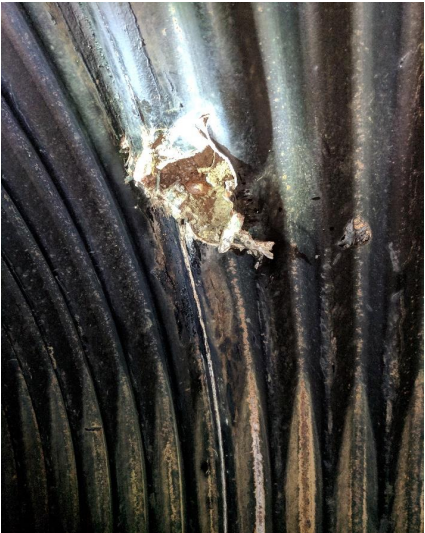
Diameter84in.

Station208+78

Length410ft.

Station212+88

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |



| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation |                    |
|-------------|--------------------|
| 1           | Major deformation  |
| 2           | Medium deformation |
| 3           | Minor deformation  |

| Invert Deterioration |             |              |                          |
|----------------------|-------------|--------------|--------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                    |
| Invert               |             |              | No deterioroartion noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Storm Drain Condition Assessment  
Field Data Log

Segment 15  
Line 2

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialRCP

Diameter66in.

Station212+88

Length24ft.

Station213+12

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert               |             |              |       |  |  |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Client:

City of Englewood, Colorado

Project:

South Englewood Storm Drain Condition Assessment

Date:

11/11/2018

Material

CMP

Diameter

84

in.

Station

213+12

Length

146

ft.

Station

214+58

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |                        |
|----------------------|-------------|--------------|------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                  |
| Invert               |             |              | No deterioration noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Storm Drain Condition Assessment  
Field Data Log

Segment 17  
Line 2

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter84in.

Station214+58

length512ft.

Station219+70

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |
|----------------------|-------------|--------------|----------------------|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |
| Invert to Springline |             |              | No deformation noted |  |
| Springline to Crown  |             |              | No deformation noted |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |                  |              |  |
|----------------------|------------------|--------------|--|
| Location             | Approx. Sta      | Rating 1 - 3 | Notes  |
| Invert               | 215+14 to 217+67 |              | No deterioration noted; debris from Sta 215+14 to Sta 217+67 |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter76in.

Station219+70

Length430ft.

Station224+00

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |                        |
|----------------------|-------------|--------------|------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                  |
| Invert               |             |              | No deterioration noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter76in.

Station224+00

Length390ft.

Station227+90

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |                  |              |   |
|----------------------|------------------|--------------|---|
| Location             | Approx. Sta      | Rating 1 - 3 | Notes   |
| Invert               | 226+29 to 226+43 |              | No deterioration noted; Debris Sta 226+29 to Sta 226+43 |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |



Storm Drain Condition Assessment  
Field Data Log

Segment 20  
Line 2  
LAST SEGMENT INSPECTED

Client: City of Englewood, Colorado  
Project: South Englewood Storm Drain Condition Assessment  
Date: 11/11/2018

|          |        |     |                |
|----------|--------|-----|----------------|
| Material | CMP    |     |                |
| Diameter | 60     | in. |                |
| Station  | 227+90 |     | Station 233+00 |
| Length   | 510    | ft. |                |

| Corrosion            |             |              |                    |
|----------------------|-------------|--------------|--------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes              |
| Invert to Springline |             |              | No corrosion noted |
| Springline to Crown  |             |              | No corrosion noted |
| Crown                |             |              | No corrosion noted |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |                      |  |  |
|----------------------|-------------|--------------|----------------------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                |  |  |
| Invert to Springline |             |              | No deformation noted |  |  |
| Springline to Crown  |             |              | No deformation noted |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |                        |
|----------------------|-------------|--------------|------------------------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes                  |
| Invert               |             |              | No deterioration noted |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |                     |
|------------------|-------------|--------------|---------------------|
| Location         | Approx. Sta | Rating 1 - 4 | Notes               |
| Joints and Seams |             |              | No separation noted |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Storm Drain Condition Assessment  
Field Data Log

Client:City of Englewood, Colorado

Project:South Englewood Storm Drain Condition Assessment

Date:11/11/2018

MaterialCMP

Diameter60in.

Station233+00

Length405ft.

Station237+05

| Corrosion            |             |              |       |
|----------------------|-------------|--------------|-------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |
| Invert to Springline |             |              |       |
| Springline to Crown  |             |              |       |
| Crown                |             |              |       |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert to Springline |             |              |       |  |  |
| Springline to Crown  |             |              |       |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert               |             |              |       |  |  |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |       |  |  |
|------------------|-------------|--------------|-------|--|--|
| Location         | Approx. Sta | Rating 1 - 4 | Notes |  |  |
| Joints and Seams |             |              |       |  |  |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |

Storm Drain Condition Assessment  
Field Data Log

Client: 

City of Englewood, Colorado

Project: 

South Englewood Storm Drain Condition Assessment

Date: 

11/11/2018

Material

CMP

Diameter

72 X 44

in.

Station

237+05

Length

93

ft.

Station

237+98

| Corrosion            |             |              |       |
|----------------------|-------------|--------------|-------|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |
| Invert to Springline |             |              |       |
| Springline to Crown  |             |              |       |
| Crown                |             |              |       |

| Corrosion Rating Scale |                  |
|------------------------|------------------|
| 1                      | Major corrosion  |
| 2                      | Medium corrosion |
| 3                      | Minor corrosion  |

| Deformation          |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert to Springline |             |              |       |  |  |
| Springline to Crown  |             |              |       |  |  |

| Deformation Rating Scale |                    |
|--------------------------|--------------------|
| 1                        | Major deformation  |
| 2                        | Medium deformation |
| 3                        | Minor deformation  |

| Invert Deterioration |             |              |       |  |  |
|----------------------|-------------|--------------|-------|--|--|
| Location             | Approx. Sta | Rating 1 - 3 | Notes |  |  |
| Invert               |             |              |       |  |  |

| Invert Rating Scale |                      |
|---------------------|----------------------|
| 1                   | Major deterioration  |
| 2                   | Medium deterioration |
| 3                   | Minor deterioration  |

| Joints and Seams |             |              |       |  |  |
|------------------|-------------|--------------|-------|--|--|
| Location         | Approx. Sta | Rating 1 - 4 | Notes |  |  |
| Joints and Seams |             |              |       |  |  |

| Joints and Seams Rating Scale |                        |
|-------------------------------|------------------------|
| 1                             | Separated (open) Joint |
| 2                             | Misaligned Joint       |
| 3                             | Faulted Joint          |
| 4                             | Partially opened       |