

**DRAFT REPORT  
CITY OF LAS VEGAS  
DOWNTOWN STORM DRAIN ASSESSMENT**

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**1.0 EXECUTIVE SUMMARY**

The CCTV inspection performed on project pipelines found no illicit connections discharging non-storm water liquids into the storm drains. The CCTV inspection did find approximately 15% of the pipelines with significant operational defects such as pipeline sags and debris (silt, sediment, gravel, and garbage). The majority of the pipelines with significant defects are located in the vicinity of the Fremont Street Experience.

Brown and Caldwell recommends that the City clean the pipelines that have debris thoroughly and on a regular basis. Subsequent to the initial cleaning, the City should have a CCTV inspection performed to confirm that the pipeline has been cleaned adequately. Additional recommendations include documenting odor complaints, sending public notices to the adjacent property owners, studying feasibility of abandoning unnecessary pipes, and completely grouting pipes and catch basins previously abandoned.

The scope of this project was to inspect the storm drain system and document odors emanating from the system. Following the recommendations listed in this report should reduce or eliminate the odors emanating from the storm drain system.

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## **2.0 INTRODUCTION**

The City of Las Vegas retained Brown and Caldwell to investigate the cause of an odor emanating from the storm drain system in and around the Fremont Street Experience. The primary goal of the project was to determine if there are illicit connections, e.g. sanitary sewer cross-connections, or illegal discharges that may be the cause of the odor. The City has received odor complaints for an extended period of time. The complaints helped to establish the project boundary being bounded by Main Street, Stewart Avenue, Las Vegas Boulevard, and Bridger Avenue.

The primary means for accomplishing the goal included inspection of the storm drain system using closed circuit television (CCTV) and visual inspection of manholes and inlets. The CCTV inspection provided an additional benefit by providing an accounting of structural and operational defects observed inside the pipelines. The key structural defects that would be recorded included cracked, fractured, broken, or missing pieces of pipe. The operational defects recorded included pipeline sags (inverse slopes), debris, and sediment. Complete definitions for the structural and operation defects are contained in the appendix.

### **3.0 ASSEMBLY AND REVIEW OF BACKGROUND DATA**

The assembly and review of background data began in the scope development phase of the project when the City provided Brown and Caldwell with as-built and design drawings of the storm drains in the downtown area. Preparing to field verify this information, Brown and Caldwell utilized the City's geographical information system (GIS) storm drain layers as a working drawing. After field verification of the drawings, the preliminary base maps were prepared, and were then used for the field survey.

#### **3.1 COLLECT EXISTING DATA**

##### **DESIGN/RECORD/AS-BUILT DRAWINGS**

The City provided as-built and other record drawings for the storm drains in the project limits. A review of the documents revealed that five storm drain systems made up the pipelines that were inspected. The five projects are summarized as follows:

##### **Fremont Street**

- Constructed in 1978, an 18" reinforced concrete pipe which runs from Main Street to Las Vegas Boulevard.
- Constructed in 1993, 18" reinforced concrete pipe which runs from Main to 1<sup>st</sup> and 4<sup>th</sup> street to Las Vegas Boulevard. This pipe was constructed with the improvements made to the Fremont Street Experience.
- Constructed in 1994, 12" reinforced concrete pipe which 1<sup>st</sup> Street, 3<sup>rd</sup> Street, and 4<sup>th</sup> Street. This pipe was constructed with the improvements made to the Fremont Street Experience.

##### **Stewart Avenue/4<sup>th</sup> Street**

- Constructed in 1995, an 18" reinforced concrete pipe which runs from 4<sup>th</sup> St. to Las Vegas Boulevard. This storm drain is located immediately in front of the City offices.
- Constructed in 1994, an 18" reinforced concrete pipe which runs from Ogden to Stewart Avenue on 4<sup>th</sup> Street.

##### **Ogden Avenue**

- Constructed in 1975, a 12" reinforced concrete pipe which runs from Casino Center to Las Vegas Boulevard.

##### **Carson Avenue**

- Constructed in 1985, an 18" reinforced concrete pipe which runs from Casino Center to Las Vegas Boulevard. This pipe was constructed as an offsite improvement to the Golden Nugget. This pipe runs directly underneath the Golden Nugget casino.
- Constructed in 1994, an 18" pipeline or 2-12" pipelines from Casino Center to Las Vegas Boulevard.

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**Bridger Avenue**

- Constructed in 1994, a 12” and 18” reinforced concrete pipes which run from Casino Center to Las Vegas Boulevard.

**EXISTING STORM DRAIN MAINTENANCE PRACTICES**

The Department of Field Operations, Streets and Sanitation Division, is tasked with cleaning and removing debris from the storm drain system. The department follows a regular maintenance schedule, shown in Appendix J, for maintaining the downtown storm drain system. This maintenance includes flushing, deodorizing, and jetting with pressure nozzles. “Flushing” involves flooding the pipe with approximately 2,000 gallons of water from a nearby fire hydrant. “Deodorizing” is accomplished by hanging circular blocks of specialized deodorant from the manhole covers and the inlet grates. “Jetting” uses a high pressure nozzle which sprays water at an angle throughout the circumference of the pipe so that the loose material is pulled downstream. If the material is large, it will not be moved by “Jetting”, in which case alternate methods of debris removal are required.

The current cleaning efforts on the Fremont Street Experience include work performed at intersections with Main Street, Casino Center, and 4<sup>th</sup> Street. The pipes are not accessed from the intermediate manholes at 1<sup>st</sup> Street and 3<sup>rd</sup> Street. The City crews have been allowed limited access to the Fremont Street Experience mall and have made a practice of not performing their operations on the Mall with the exception of Casino Center and 4<sup>th</sup> Street. Depending on the length of the hoses which are used, by not entering the mall the effectiveness of the cleaning operations is limited. The primary method of maintenance is flushing, which is not a proactive method of debris removal in light of its limitations.

**3.2 BACKGROUND DATA FIELD VERIFICATION**

The first step in investigating the odor in the pipelines was to verify their existence. Several site visits were conducted by Brown and Caldwell personnel and City staff to make this appraisal. Digital photographs were taken to document the location of the visible above ground components. These were later used to assist the CCTV subcontractor in identifying the point of entry into the pipelines. The results of the field verification efforts are summarized below.

**3.3 ACCESS TO MANHOLES AND DRAIN INLETS**

Brown and Caldwell performed a field investigation to determine the accuracy of the data. The investigation generally confirmed that the location of the pipelines, inlets and manholes are as shown by drawings provided. The data indicated a total of 45 manholes and 56 drain inlets would be found during the field verification. The field crew was not able to find 5 manholes and one drain inlet. It is assumed that these structures have been paved over; although the design may have been modified in the field. Brown and Caldwell requested that the City have their crews uncover these structures.

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The field investigation revealed three locations where drain inlets and one with a manhole that were not on the as built plans. The additional inlets all appeared to be connected to the mainline pipe. The additional structures, and the pipelines connecting them to the collector system, added approximately 110 LF to the quantity of pipe for CCTV inspection. After field verification of the maps and drawings provided by the City, Table A “Pipe Proposed For Inspection” was developed.

Table A Pipe Proposed for Inspection

MAP NUMBER	PROJECT NAME	DATE BUILT	LOCATION	PIPE LENGTH (FT)	SIZE OF PIPELINE (IN)
327-V158A	FREMONT STREET STORM DRAINAGE SYSTEM	1978	FREMONT STREET/1 <sup>ST</sup> TO LVB	1706	12, 18
107-V2224 (23, 26)	THE FREMONT STREET EXPERIENCE	1994	FREMONT/MAIN TO 1 <sup>ST</sup> FREMONT/4 <sup>TH</sup> TO LVB	1444	6, 12, 15, 24
107-V2224 (30, 31)	THE FREMONT STREET EXPERIENCE	1994	3 <sup>RD</sup> ST @ FREMONT ST 1 <sup>ST</sup> ST @ FREMONT	816	6, 12
107-V2224 (29)	THE FREMONT STREET EXPERIENCE	1994	4 <sup>TH</sup> STREET/CARSON TO FREMONT	447	12, 18, 24
327-V241	STEWART AVENUE STORM DRAIN	1995	STEWART AVENUE/4 <sup>TH</sup> TO LVB	534	12, 18
327-V149	OGDEN AVENUE IMPROVEMENTS STORM DRAIN	1975	OGDEN AVENUE/C.CTR TO LVB	1323	8, 12
107-V1365	GOLDEN NUGGET OFF-SITE IMPROVEMENTS C-163	1985	CARSON/1 <sup>ST</sup> TO C.CTR	681	12, 18
327-V238	CARSON AVENUE STORM DRAIN	1994	CARSON/C.CTR TO LVB	1905	2-12, 18
307-V704	MAIN STREET SEWER COLLECTOR	1994	BRIDGER/C.CTR TO LVB	1365	12, 18
327-V164	STORM DRAIN - 3RD STREET	1978	3 <sup>RD</sup> ST/CARSON TO FREMONT	230	10, 12
107V-2288	DOWNTOWN CORRIDOR IMPROVEMENTS	1994	4 <sup>TH</sup> STREET/OGDEN TO STEWART	687	18
ADDITIONAL LATERAL	N/A	N/A	STEWART WEST OF LVB	60	N/A
ADDITIONAL LATERALS	N/A	N/A	OGDEN WEST OF LVB	50	N/A
<b>TOTAL</b>				<b>11248</b>	

### 3.4 PREPARATION OF PRELIMINARY BASE MAPS

Preliminary base maps were prepared utilizing the Clark County geographical information system (GIS) shape files and information from the design drawings to establish working drawings for field investigations. The Clark County GIS data includes the street centerlines and the assessor parcels, which shows property boundaries and on the street side represents the assumed edge of right of way. The GIS data of the City storm drain elements only generally

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presented the horizontal location of the pipelines as running along the roadway centerline. After the field verification the GIS storm drain information was removed from the maps and replaced with hand drafted lines for the pipes, solid circles for the manholes, and boxes for the drain inlets. The preliminary base maps were not survey accurate but allowed for tracking and identifying the location of the pipelines, manholes and drain inlets.

#### **4.0 FIELD INVESTIGATION PROCEDURES DEVELOPMENT**

The City has not previously inspected storm drain pipeline using CCTV equipment. The City's standard for CCTV inspections of their sanitary sewer pipelines is the NASSCO PACP program. The City agreed that a modification of the program would be suitable to identify the structural and operational defects that would be recorded in the CCTV images. The refining of the procedures was developed as follows below.

#### **4.1 DEVELOP DATA COLLECTION PROCEDURES**

Brown and Caldwell developed data collection procedures for various aspects of the project. These included data collection for closed-circuit television inspection (CCTV) inspection, data storage, GPS survey, and future integration with City GIS. CCTV data collection procedures used the Pipeline Assessment and Certification Program (PACP) developed by the National Association of Sewer Service Companies (NASSCO). This program is discussed in more detail in "4.3 Prepare Standards for Classifying Observations". The data for the CCTV inspection is digital and is stored on CDs or DVDs. The video format is MPG II or better quality. MPG II is a compressed version of digital video and is commonly used for CCTV inspection video. Survey data is provided in U.S. survey feet, State Plane Coordinates, Nevada East Zone, North Horizontal Datum 1983 (NAD 83), and North America Vertical Datum 1988 (NAVD 88). This is the same coordinate system that the City uses for their GIS database.

#### **4.2 MANHOLE NUMBER CONVENTION**

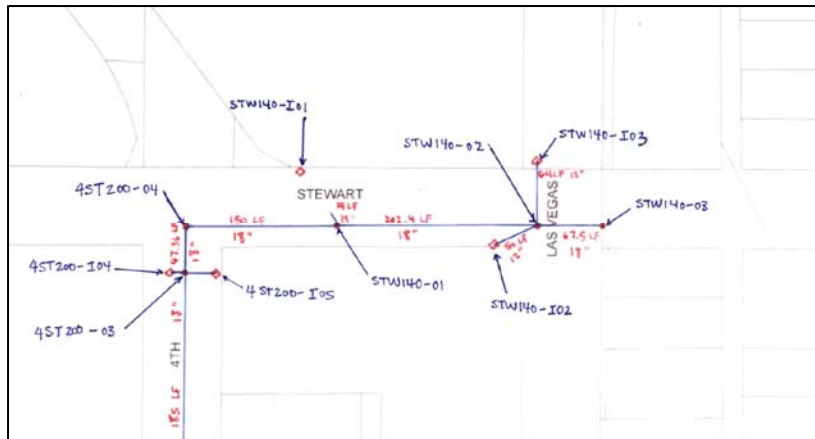
Brown and Caldwell met with the city and discussed the manhole numbering convention for the project. The City Flood Control Section currently uses the "IDMile" naming convention. The "IDMile" naming convention consists of 6 characters, 3 letters and 3 numbers, e.g., FMT001. In this example "FMT" stands for Fremont Street and "001" is an arbitrary starting point. This naming convention originally represented a unique mile along a river, channel or wash and was adopted by the Clark County Regional Flood Control District. Whenever the Regional Flood Control district constructed pipelines which were transferred to the City, these pipelines were named with the IDMile naming convention.

The mainline pipe in Fremont Street begins with FMT001, and as it heads east it changes whenever the pipe material or size changes. This does not always happen at a manhole, and thus the beginning and ending points are sometimes difficult to define. Closed Circuit Television Inspection (CCTV) inspection of pipelines is performed by defining the number of the beginning access point---manhole, catch basin, or junction box---as the "from" point and the ending access point as the "to" point. Each defect is located by the distance from the starting or "from" access point. For this reason the access points need to be numbered/named uniquely so that the video data and its corresponding defects can be quickly located.

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The City desired to continue to use the “IDMile” convention and has provided existing GIS data labeled in this system. The City elected to permit Brown and Caldwell to name the manholes and drain inlets using the existing “IDMile” system and improvise as necessary. When the City receives the survey and CCTV they will modify the naming to fit their convention.

The adopted convention was to name the manholes starting from the upstream end going to the downstream end using the current “IDMile” of the pipeline. An example of this is shown below.



**Figure A Storm Drain Feature Naming**

**NAMING RULES**

**Manholes**

1. Add -01 after IDMile
2. Increment Downstream
3. Defer to Upstream Numbering

**Drain Inlets**

4. Add -I01 after IDMile
5. Increment Downstream
6. Defer to Upstream Numbering
7. Start on Northeast side

By far the biggest problem with the using the system for this project is that the GIS data is not always accurate, as discussed previously, and thus pipes that are found in the field but not shown in the GIS must be named arbitrarily. Also pipelines that are parallel but begin and end at the same manholes must be given new names. See Appendix A for the “Preliminary Base Maps” with manhole and drain inlet names, pipe lengths, and pipe diameters. See Appendix B for the “Revised Maps” with aerial background.

### **4.3 PREPARE STANDARDS FOR CLASSIFYING OBSERVATIONS**

Three standards for classifying observations were required: inspection of the pipelines, manholes, and drain inlets.

#### **PIPELINE CODING SYSTEM**

The pipeline was inspected per the NASSCO Pipeline Assessment Certification Program (PACP) coding system as previously stated. The system, developed for condition assessment of sanitary sewer pipelines, provides a defect coding system for structural, operational and maintenance, construction, and miscellaneous defects. For example an operations and maintenance defect might be coded “Settled Deposit”, which may be used to describe sand or gravel in the invert of the pipeline. This defect is given a value which represents the percentage of the cross sectional area blocked. If the debris continues for more than 3 feet it is given a starting and ending point as measured from the access manhole. An inclusive list of the defect codes is found in Appendix C. PACP provides guidance defining good video inspection procedures. Examples of such procedures are the maximum rate at which the camera is advanced through the pipe, centering the camera along the pipe axis, and avoiding excessive use of the pan and tilt feature of the camera.

### **4.4 DEVELOP DEFECT LOG FORMAT**

The CCTV inspection video is accompanied by defect logs of two different formats. The first log is the NASSCO PACP standard defect log which was formulated to maximize the amount of information shown. The second format shows a graphical representation of the pipeline with from- and to-manholes. The defect/observation locations are indicated with a leader and a description.

The manhole inspection and inlet inspection are incidental to the pipeline inspection, and have been inspected for general structural, operational, and miscellaneous features. These structure inspections have been documented using the same log.

### **4.5 SAFETY AND EMERGENCY RESPONSE ACTION PLAN**

The safety and emergency response plan for the CCTV inspection work includes a project summary, key personnel and responsibilities, training requirements, and equipment. The safety and emergency response plan will be augmented to include information on smoke testing if Brown and Caldwell receives authorization to perform such work. The work shall be performed in accordance with the City of Las Vegas and OSHA requirements.

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**PROJECT SUMMARY**

The project requires video inspection of approximately 11,500 linear of pipeline and 50 manholes. The CCTV inspection of the pipeline requires accessing the pipeline through the manholes and drain inlets. Manhole and drain inlet inspection will be performed from the surface by removing the manhole covers or grates. The manholes are generally located in the paved roadways, and within the Fremont Street Experience.

**TRAINING REQUIREMENTS**

Training requirements for personnel included OSHA Confined Space Entry, California Environmental Water, and CCTV equipment manufacturer specific training. Additional certifications recommended but not necessary are the NASSCO PACP coding system and the Environmental Manager certification.

**EQUIPMENT**

The necessary equipment for the CCTV inspection includes a truck, computer, track and wheel mounted cameras, hard hats, steel toed boots, and miscellaneous tools used to adjust the camera height. Traffic control includes barricades, orange cones, flags, strobe light flasher, and orange construction vests. For night work, lighting equipment was also necessary.

## 5.0 CONDUCT PHYSICAL INSPECTIONS

### 5.1 INSPECTION SCHEDULE

An inspection schedule was discussed in the bi-weekly meetings with the City. This schedule included approximately two weeks for CCTV pipeline and structure inspection.

### 5.2 TRAFFIC CONTROL

All work was performed according to the City of Las Vegas traffic control permits acquired for these projects. Generally traffic control included a shadow truck in conjunction with cones placed to direct traffic. A “shadow truck” is about the size of a work pickup truck that has flashing lights which alert and direct oncoming traffic.

### 5.3 PERMITS/COORDINATION

The only permit required was the City of Las Vegas traffic control permit. Brown and Caldwell met with the Fremont Street Experience (FSE) to coordinate the work to be performed on their “mall”. They required a variety of things from the CCTV subcontractor:

- Full-time presence of an FSE worker to place barricades and remove/reset manhole covers
- Hourly schedule from 9 am to 3 pm
- Specific starting and ending locations for morning and afternoon
- Specific dates for working
- Protection of mall surface by driving and parking on tarps

These requirements were met in full by Brown and Caldwell’s subcontractor.

### 5.4 MANHOLE AND INLET DOCUMENTATION

Brown and Caldwell’s subcontractor performed a surface inspection of the manholes and drain inlets shown on the field verified drawings. The inspection form developed in Technical Memorandum II was used to perform these inspections. The inspection logs and photographs are provided in their entirety in Appendix D, E, and F.

#### MANHOLES

Additional, covered, and missing manholes discovered by the pipeline inspection and are shown here in Table B.

**Table B** Manholes: additional, paved over, or missing

MHID	Figure	Location	Comment
LVB 139-03C	2	~ 17' east of LVB 139-02	Additional manhole
LVB 139-03B	2	~ 174' west of LVB 139-04	Additional manhole
LVB 139-03A	2	~ 80' west of LVB 139-04	Additional manhole

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<b>MHID</b>	<b>Figure</b>	<b>Location</b>	<b>Comment</b>
LVB 136-02A	3	~ 35' east of LVB 136-01	Additional manhole
LVB 136-02B	3	~ 80' east of LVB 136-01	Additional manhole
LVB136-05	3	~ 82' east of LVB 136-04	Paved Over
CSN 030-02	4	~ 77' east of CSN 030-01	Paved Over
BRI 002-04	5	~ 150' west of BRI 002-05	Does not exist

The manhole inspections discovered 8 of 48 manholes from which malodorous smells were emanating (6 of 8 on Fremont Street Experience) and 15 of 48 manholes with garbage and/or sediment. Table C lists the manholes with odor emanating, garbage, or other debris.

**Table C** Manholes with Odor, garbage, or other debris

<b>Manhole Number</b>	<b>Location</b>	<b>Comment</b>
CSN010-01	Casino Center Blvd.	Unusual Odor: cleaning solution.
FMT000-02	Fremont St. / 1st St.	Unusual Odor: cleaning solution.
FMT000-03	Fremont St. / 1st St.	Unusual Odor: cleaning solution.
FMT012-02	1st St. / Fremont St.	Grease: light grease. Unusual odor: cleaning solution & trash. When pulling camera out of MH, white water flowed into MH from south line. Could not locate source.
CSN020-02	Carson Ave. / 3rd St.	Debris: garbage. Unusual Odor: smells like trash.
LVB139-01	Ogden Ave. / Casino Center Blvd.	Debris: garbage. Unusual Odor: trash.
FMT008-01	3rd St. / Fremont St.	Grease: light grease. Unusual odor: H2S > 10ppm.
LVB136-03	Fremont St. / 4th St.	Grease: light grease. Unusual odor: H2S 7.8ppm.
4ST200-03	4th St. S. of Stewart Ave.	Silt: 2-4". Debris: trash and rocks.
CSN010-02	Casino Center Blvd. / Carson Ave.	Grade Ring: cracked. Debris: garbage & dirt.
CSN020-01	Carson Ave. & E. of Casino Center Blvd.	Debris: garbage.
FMT007-02	4th St. N. of Bridger Ave.	Insects: few. Silt: 1". Debris: trash.
LVB136-01	Fremont St. / Casino Center. Blvd.	MH cover: broken. Grease: light grease. Debris: trash.
LVB136-04	Fremont St. / Las Vegas Blvd.	Grease: light grease. Debris: trash. Unusual odor: decaying garbage.
LVB139-03	Ogden Ave. / 4th St.	Grade Ring: cracked. Grease: light grease. Silt: 1 1/2". Debris: leaves and trash.
LVB139-04	Ogden Ave. / Las Vegas Blvd.	Silt: 2". Debris: garbage. Standing Water: 3".
STW140-01	Stewart Ave. E. of 4th St.	Insects: few roaches. Silt: 1-2". Debris: trash. Slight cracks in chimney.
BRI003-01	Bridger Ave. W. of Las Vegas Blvd.	Insects: few roaches. Influent #3 ~ 2" flow, <2fps.
CSN020-04	Carson Ave.	Insects: few. Debris: light debris.
CSN030-01	Carson Ave. W. of Las Vegas Blvd.	Insects: few roaches. Standing Water: 3".
FMT007-03	4th St. N. of Bridger Ave.	Insects: few roaches.
FMT010-01	Las Vegas Blvd. / Fremont St.	Insects: few roaches.
4ST200-02	4th St. N. of Ogden Ave.	Debris: rocks.
LVB139-06	Ogden Ave. / Las Vegas Blvd.	Debris: rocks and gravel.

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**DRAIN INLETS**

Generally no strong smells were noted as coming from the drain inlets/catch basins. 24 of the 56 inlets retained some debris or trash when the surface inspection was performed. Additionally from the CCTV inspection of the pipelines, 4 of the catch basins had 3” to 12” of standing water.

**5.5 MAN ENTRY INSPECTIONS**

No man entry inspections were performed. This was an additional service item which was not necessary.

**5.6 CCTV INSPECTIONS**

The CCTV inspections were performed according to NASSCO PACP standards discussed in Technical Memorandum II section 4.4 and 4.5. The inspection lasted approximately two weeks and ended by the 1<sup>st</sup> of November 2004. Pipe defects which are operational are more likely to cause malodorous smells, and thus the following three “major defects” were considered: pipeline sags or inverse sloping pipe, debris (garbage, silt, gravel, and grease) greater than 15% in pipe cross section. Using these major operational defects as criteria, a query was performed which yielded 17 pipe segments with such defects. After generally prioritizing by defect magnitude, i.e. percentage of the pipe cross section restricted or occupied, Table D “Pipes with Major Defects” was generated as shown below. It should be noted that 6 of the 10 most significant defects are found on or nearby the Fremont Street Experience. These pipe defects include for example 1 connector pipe which is 50%-100% full of gravel or sediment, 3 pipe sags, and 4 unconfirmed pipe sags. The two other connector pipes that are on Fremont Street Experience (Major Defects Items 6 and 7) are laterals that were abandoned by City maintenance crews, but the drop inlet and catch basin are still active. For the complete findings from the CCTV inspection see Appendix G Pipe Inspection Summary, Appendix H CCTV Pipe Inspection Logs, Appendix I Captured Images of Defects, and the CCTV inspection video provided on CD with this report.

No cross-connections between sanitary and storm sewers were found and confirmed. However, about 10% of the pipe was not accessible for inspection, and without further inspection the lack of cross-connections is not known for certain.

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**Table D Pipes with Major Defects**

<b>Priority #</b>	<b>CERTIFICATE #</b>	<b>FROM NODE</b>	<b>TO NODE</b>	<b>PIPE SIZE (CCTV)</b>	<b>Comment*</b>	<b>LOCATION</b>
1	024A	LVB136-04_1	LVB136-05_1	18	Pipe Sag 30% (30' long). Hole. Intruding Lateral.	<b>Fremont St. &amp; LVB</b>
2	009	FMT012-02	FMT012-01	12	25% Debris Continuous.	1st N. of <b>Fremont</b>
3	023	LVB136-03	LVB136-04	18	Pipe Sag or Debris >=30% (length unknown). Fracture.	<b>Fremont St. &amp; 4th St.</b>
4	093	STW140-01	STW140-02	18	Pipe Sag or Debris >=30% (length unknown).	Stewart Ave. W. of LVB
5	070	CSN010-02	CSN010-I03	18	Large Intruding Lateral.	Carson Ave. & Casino Center
6	064	LVB136-03	FMT010-I01	12	Defective Abandoned Lateral	<b>Fremont St. &amp; 4th St.</b>
7	066	LVB136-04	FMT010-I02	12	Defective Abandoned Lateral	<b>Fremont St. &amp; LVB</b>
8	029	FMT008-I02	FMT008-I01	12	Pipe Sag >=30% (>= 10' long).	3rd N. of <b>Fremont St.</b>
9	103	4ST200-01	4ST200-I02	18	100% Debris. Potential Defective Abandoned Lateral	4th St. S. of Ogden
10	102	4ST200-03	4ST200-I05	18	30% Debris (5' long).	4th St. S. of Stewart
11	022AA	FMT008-01_2	LVB136-03_2	18	Pipe Sag 15% (40' long). Multiple Cracks/Fractures.	<b>Fremont St. Between 3rd &amp; 4th</b>
12	068	CSN010-I03	CSN010-02	18	Large Miscel. Debris (point defect). Fracture/Hole.	Carson underneath Golden Nugget
13	074	CSN010-02	CSN010-I05	12	20% Debris (5' long)	Carson Ave. & Casino Center
14	096	4ST200-01	4ST200-02	18	20% Debris (length unknown). Standing water backed up from downstream.	4th St. & Ogden
15	098	4ST200-02	4ST200-03	18	20% Debris (length unknown). Standing water backed up from downstream.	4th St. N. of Ogden Ave.

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<b>Priority #</b>	<b>CERTIFICATE #</b>	<b>FROM NODE</b>	<b>TO NODE</b>	<b>PIPE SIZE (CCTV)</b>	<b>Comment*</b>	<b>LOCATION</b>
16	012	FMT012-02	LVB136-01	18	15% debris (20' long), intruding laterals and crack.	<b>Fremont St. &amp; Casino Ctr.</b>
17	013, 026A	LVB136-01	LVB136-02	18	15% (60' long) debris and intruding laterals.	<b>Fremont St. &amp; W. of Casino Ctr.</b>

\*Note: "15% debris" means that 15% of pipe cross section is occupied by some form of debris. ">=" means "greater than or equal to".

**5.7 PIPELINE ACCESSIBILITY/DEBRIS REMOVAL**

Brown and Caldwell's CCTV subcontractor was diligent in inspecting each of the pipelines and structures noted in the scope of work. When debris was found in the pipelines which impeded progress, a reverse inspection was performed. In some cases the reverse inspection was not able to be performed due to additional debris or high water. Other pipes, specifically laterals on the Fremont Street Experience, were not inspected due to a lack of surface access points, i.e. cleanouts or inlets. Those pipes not inspected are shown in Table D below.

**Table D** Pipe Not Inspected

<b>FIGURE NO.</b>	<b>UPNODE</b>	<b>DNNODE</b>	<b>LENGTH NOT INSPECTED</b>	<b>REASON</b>
1	4ST200-02	4ST200-03	28	Debris
1	STW140-02	STW140-I03	64	Do not exist
1	STW140-02	STW140-03	68	Do not exist
2	4ST200-01	4ST200-02	73	Debris
3	FMT012-01	FMT012-02	57	Debris
3	LVB136-03	LVB136-04	341	Debris/High Water
3	FMT000-01	FMT000-02	480	Fremont Laterals, no access.
3	FMT010-01	FMT010-02	65	Technical difficulties
4	CSN010-I03	CSN010-02	69	Debris

TOTAL UNINSPECTED  
PIPE **1245**

## **6.0 CONCLUSION**

### **6.1 DISCUSSION OF RESULTS**

#### **ILLICIT CONNECTIONS AND/OR DISCHARGES**

The presence of a “white substance” noted in a manhole (FMT012) was the only illicit discharge observed in the inspection. Four other laterals were clearly active, as seen by flow coming into the mainline, but no obvious discoloration of the liquid was noticed from the video.

#### **PIPELINES WITH MAJOR DEFECTS**

The condition of the pipes can be discussed in structural and operational defects. Of the 106 pipeline video segments, 18 have major defects. For the purposes of this study major operational defects are defined as defects which impede the storm water flow equal to 15% or greater in cross section. Defects causing standing water are likely to cause odor problems. Major structural defects are the following: fracture multiple, large hole, and broken pipe. Two of the pipelines have major structural defects. These defects are not in a state of imminent failure.

#### **OTHER PIPELINES (WITHOUT MAJOR DEFECTS)**

Of the 106 pipeline video segments 17 have been chosen which have major defects. The other 89 pipeline segments are in good condition and had minimal or no flow. The pipes are made of reinforced concrete and are not corroding or decaying at marked rates due to hydrogen sulfide gases or other corrosion mechanisms.

### **6.2 RECOMMENDATIONS**

Brown and Caldwell recommends that the City implement the following items to eliminate or reduce the odors emanating from the storm drains in the downtown area. This action plan includes the following elements:

1. **Cleaning and Debris Removal (Major Defect Pipe Numbers 1-4, 9, 10, and 12-17)**  
Clean and remove the debris from the pipelines using a vactor truck or similar equipment with a high pressure nozzle spray and vacuum for removing the debris from the manholes. The pipe should then be re-inspected with CCTV equipment to confirm that each pipeline has been successfully cleaned. This work should be performed from each manhole, especially on the Fremont Street Experience.
2. **Document Odor Complaints**  
Make a log of all odor complaints for the downtown area. This log should include documenting the location, time, date, and nature of the smell. If the odor problem continues, then the City will have better records to isolate the offending source.
3. **Public Relations**  
Discourage property owners from putting debris or non-storm liquids down the storm drain inlets or grates.

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4. Develop Pipe Cleaning Plan (Major Defect Pipe Numbers 1-4, 9, 10, and 12-17)  
For the areas where the most debris has accumulated, cleaning the pipe at regular intervals may be necessary. This means regular access to the Fremont Street Experience is required. This interval must be determined by the City crews over time, but should likely start with shorter intervals like every 6 months and gradually increase to an equilibrium point.

5. Repair Pipelines with Sags (Major Defect Pipe Numbers 1, 8, and 11)  
If odor complaints continue, after initial pipe cleaning, the pipelines with sags should be repaired or abandoned, if the local system has sufficient redundancy.

The repair may be accomplished by removing and replacing the pipe by excavation or the sag may be filled in with grout. The latter repair will reduce capacity. The first method, removal and replacement, can be performed by City crews or by a local Contractor depending on the availability of City crews. The second method should be performed by a company specializing in pipe point repairs and will require CCTV equipment to monitor the progress of the work.

There are three confirmed pipeline sags (Major Defect Pipe Numbers 1, 8, and 11) and another four that are potential sags (Major Defect Pipe Numbers 3, 4, 14, and 15). The potential sags may simply be debris; however, that will not be confirmed until after the pipe is cleaned and re-inspected. After re-inspection the City should study their local system further to determine the potential for abandonment of the pipelines with sags in lieu of excavation for removal and replacement.

6. Completely Fill Partially Abandoned Laterals (Major Defect Pipe Numbers 6 and 7)  
The City crews should grout solid the pipelines and catch basins previously intended for abandonment.