

Damaged Lines in Morro Bay's Wastewater Collection System

Causes and Effects

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Introduction

Morro Bay's aging wastewater collection system is composed primarily of clay pipe. In many areas, cracks and breaks have occurred, and joints between pipe sections have loosened and broken.

Because of a long history of deferred maintenance of the wastewater collection system, it is suspected that the situation has existed for some time. However, there has been no official word of the problem from City government.

The damaged lines are allowing sewage to leak into our soil. This leakage from the system into the soil is known as "exfiltration". Exfiltration in Morro Bay is creating a significant risk to our health, and damaging the environment. Not only are our soil and groundwater polluted by raw sewage, but pollution that goes into the groundwater goes into the Bay and the Ocean.

This report describes some of the causes and effects of damage to our sewer lines, and identifies some of the ongoing and potential impacts to our city.

Evidence of Damaged Lines

Backups and Overflows

Sewer line backups and overflows are regular occurrences in Morro Bay. Residents report that workers often tell them the problem is caused by tree roots. Trees provide an effective, if inconvenient means of detecting sewer line damage, provided they are present over damaged lines, and their roots extend deep enough to contact those lines. As the tree roots seek out water, they grown into openings in the damaged pipes, and eventually form root balls that cause the backups.

Since it is improbable that there is a tree, with roots that extend deeply enough to contact sewer lines, over every damaged line in Morro Bay, these incidents probably represent just the "tip of the iceberg". Obviously, a method that is less disruptive, and that will be effective in all areas, is preferable, and would likely reveal far more damaged lines.

Wallace Report

In May of 2006, the City received the "Final Report, Sewer Collection System Master Plan Update", prepared by the Wallace Group. This report contains statements of concern regarding inflow and infiltration (I/I). Infiltration occurs in wet conditions, through the same openings that allow sewage to leak out of the lines (exfiltration).

The consultants' research resulted in various recommendations to identify and address problems in our wastewater collection system. A key recommendation pointing to concerns over damaged lines is that the City should:

"Implement a program to identify sources of inflow and infiltration through out the collection system and implement measures to mitigate the I/I sources once identified. ..The priority for targeting I/I identification and source removal programs within the City's collection system are summarized as follows (1 being the most severe I/I problem)

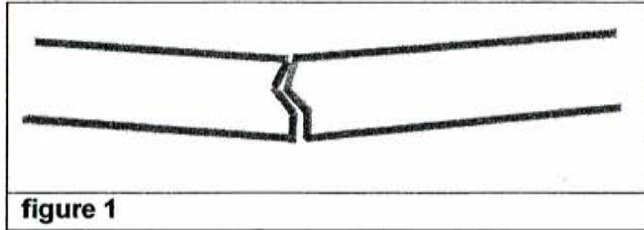
1. Basin A07
2. Basin A06 Upper
3. Basin A01c
4. Basin A05
5. Basin A06 Lower
6. Basin A04
7. Basin B03
8. Basins B01 and B02
9. Basins A03
10. Basin A01b
11. Basin A02
12. Basin A01a
13. Basin TP"

The consultants suggest that City's I/I source identification program should include further wet weather monitoring of "hot spots", smoke tests in suspect areas of high inflow, video inspection of sewers with high potential for I/I.

Common Types of Line Damage

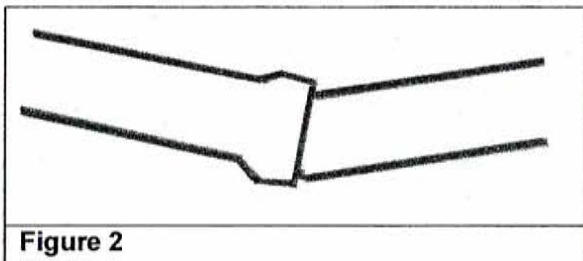
Crack/Break

Clay pipe is rigid, and will crack, and eventually break, if sufficient force is applied (**figure 1**).



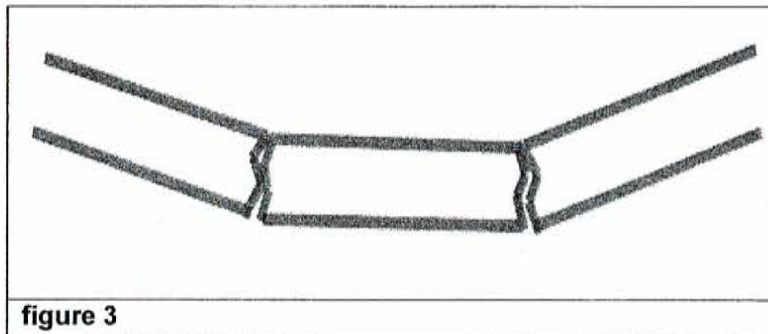
Broken Joint

Joints between pipe sections may break open under sufficient force. (**figure 2**) The overlap of two clay pipe sections is only about 1 ½ inches.



Belly

Multiple cracks, and broken joints may form a configuration known as a "belly" (**figure 3**).



None of these conditions are likely to be detected unless regular inspections of the system are done, or unless detection occurs through a far less desirable "method" – a sewage backup due to debris or roots entering the pipe through a crack or loose joint.

Offset

In some cases, after a break occurs the pipe on one side of the break moves at a different rate than the section on the other side, offsetting the ends of the pipe (**figure 4**).

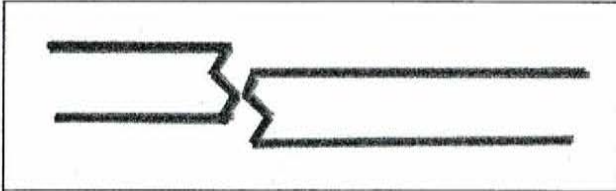


figure 4

Causes and Contributing Factors

Hillside Soil Movement

On our hillsides, gravity, water, and the composition of the soil can all contribute to soil movement. The soil is dynamic, and tends to move very slowly, over time. Occasionally, a sudden and noticeable slide will occur, but in Morro Bay, most of the hillside soil displacement that we have seen occurs very gradually. Unfortunately, whether the soil moves slowly or quickly, the forces it exerts will still eventually crack and break our sewer lines.

Sinking of Soil in Flat Areas and Depressions

In flatter areas, very wet conditions can cause the soil to sink. Such conditions may result from natural weather events, or they may result from manmade drainage problems, which can include roof runoff, improper grading, and excessive drainage due to excessive use of impermeable materials.

Excessive weight can cause the soil to sink. This can occur in a variety of circumstances, such as situations where there is construction over a sewer line.

Earthquakes

This most obvious cause of soil movement occurs frequently in our area, although most quakes are small and often not noticeable. However, a small quake that is scarcely felt can still damage the lines.

Effects on the Community and Environment

Exfiltration of Sewage Into the Soil

Exfiltration is the leakage of raw sewage through breaks in the lines. Because of the poor condition of so much of Morro Bay's collection system, it is likely that significant exfiltration is occurring throughout the City.

The amount of exfiltration that occurs at a given location depends upon various factors, such as the size of the break, the amount of flow through the line, and the permeability of the soil.

In situations where the pipes are below the groundwater level, exfiltration will not occur, but this situation is rare for Morro Bay, and would normally be expected only after heavy rains, or in areas where there are major drainage problems. Most of the time, our sewer lines are above the level of the groundwater.

When the flow of wastewater through a defective pipe begins to exceed the capacity of the pipe, the rate of exfiltration increases even further, due to the force exerted by the wastewater. Capacity may be exceeded when there are too many users for the size of the line, or when water from outside sources enters the system.

The potential health and environmental impacts of allowing sewage to leak continuously into the soil are significant, and widely discussed in various publications, so they will not be discussed in detail here. Let it suffice to say that there are reasons why we build sewage disposal systems; dumping raw sewage into the ground is not a wastewater disposal "solution".

Sewage Backups

Figure 5 represents an aerial view of a Morro Bay neighborhood. Several homes are connected, by typical 3"–4" lateral lines to a typical 6"–8" sewer line owned by the City. The direction of flow in that line, as indicated by the arrow, runs from left to right. Roots from a tree between houses

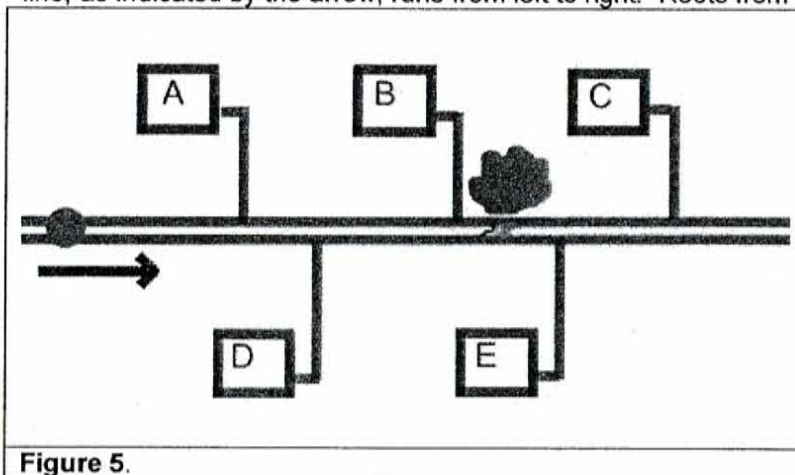


Figure 5.

B and C have entered the sewer line through a crack, and formed a root ball.

When the root ball has sufficiently blocked the line, a backup will result. When the backup occurs, the sewage will begin to exit the system, following the path(s) of least resistance. In this example, houses C and E will not be affected, as they are downstream from the obstruction. However, if houses A, B, and D do not have backflow preventers on their lateral lines, sewage from the City's line will begin

to back up into the houses.

If the houses do have backflow preventers, the sewage will begin exiting the system through the manhole, represented by the circle at the left end of the line. The sewage will then back up into the street, and continue doing so until the obstruction is removed.

Figure 6 represents an actual incident that occurred on St. Mary Avenue in Cayucos, during the summer of 2003.. In this side view, we see houses on the hillside street, with an obstruction in the sewer line, at the bottom of the hill, just below house C.

House C did not have a backflow preventer, and sewage from the line backed up into the house. Because the house was a second home, the problem was not discovered until the sewage inside the house had reached a depth of six feet.

Given the large number of hillside homes in Morro Bay, this scenario could definitely be repeated here. Because the City is responsible for maintaining its lines in good condition, there is significant liability.

Residents of Morro Bay report regularly-occurring problems with sewage backups in their neighborhoods, and are frequently told that they are caused by tree roots. This could happen here.

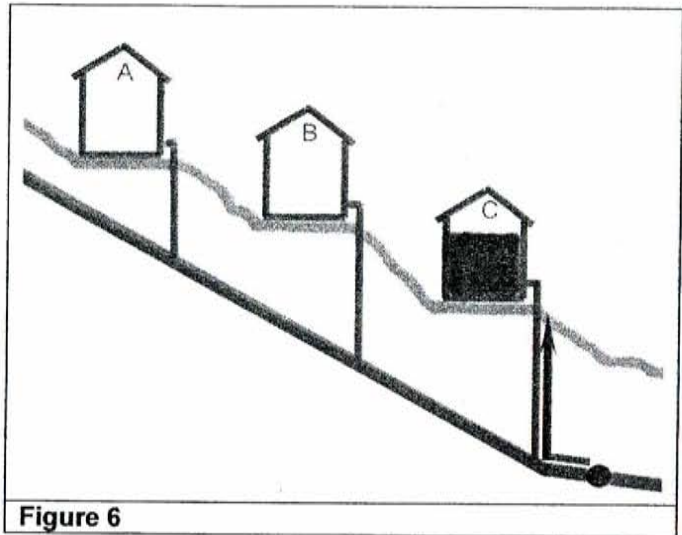


Figure 6

Potential Impacts on the New Wastewater Treatment Plant

Because the extent of damage to our lines is not currently known, we are not in a position to make reliable estimates of the required capacity for the new plant. This is compounded by the fact that Cayucos also has extensive damage to its lines, and known problems with poorly constructed connections between lateral lines and the community's wastewater collection system.

Until we find and repair the damage, we do not know what the real capacity requirements of the new system will be. This makes identification of the damage an urgent matter, as planning for the new infrastructure is well underway.

Recommendations

1. **Develop and implement a program to systematically inspect the lines**, with emphasis on those with known problems, those areas known to be served by clay pipe, and older areas of the City where lines have not been upgraded.
2. **Conduct the inspections** as rapidly as staffing and funding will permit.
3. **Repair the system**, beginning with the areas where exfiltration risks are found to be the greatest.
4. **Improve the City's regular inspection and maintenance program** to avoid future problems.
5. **Defer final specifications for the WWTP until true capacity requirements are known.**

Wastewater Treatment Plant Joint Powers Agreement

Financial Impacts on Morro Bay

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Introduction

The current Joint Powers Agreement (JPA), written by a Cayucos Sanitary District Board member, and enacted in October, 1982, has serious flaws that create financial risks and exposures for Morro Bay.

Due to inadequacies in the JPA, and failure/inability to enforce its existing provisions, Morro Bay is unable to fully control its expenditures for the Wastewater Treatment Plant and Collection System now, and in the future. Excessive expenditures are, and may potentially be, due to the following:

- Insufficient control over Main Street trunk lines
- Inability to manage costs related to defective collection infrastructure in Cayucos
- Inability to predict/manage the amount of future WWTP and trunk line flows from Cayucos
- Lack of appropriate formal agreements covering services to the State Parks
- Potentially unfavorable terms covering by-products of wastewater treatment

Updates to the agreement are necessary to protect Morro Bay's financial interests.

Insufficient Control Over Main Street Trunk Lines

1. Cayucos Line – Inflow and Infiltration

Issues:

The JPA does not provide Morro Bay with the power to ensure that Cayucos pays for the processing of the extra wastewater that enters the Cayucos trunk line during wet weather, or to fix the line so that inflow and infiltration do not occur.

The Cayucos trunk line is located in an area where flooding occurs during winter rains. Morro Bay has no way of measuring how much inflow and infiltration of this line contribute to the amount of wastewater coming through the line to the WWTP. Charges for Cayucos' flows into the WWTP are based on flow meter readings upstream of the trunk line, at lift station 5 at Toro Creek.

Financial Impacts:

1. Inflow and infiltration of the Cayucos line can contribute to surcharging events at the WWTP – events for which both Morro Bay and Cayucos are liable.

2. On page 13, is the statement: "*Determination of Actual Usage: On or before January 31 of each year, Cayucos and Morro Bay at their joint meeting shall determine by examination of operations performed to that date the proportion of sewage attributable to each party and the result thereof will be the proportion which each party agrees to pay in making payment of the operation and maintenance costs for the following year from January 1 through December 31. Notwithstanding the foregoing, at the end of each year, the cost shall be allocated and readjusted on the basis of the use that has actually occurred in the immediately preceding year. Further, Cayucos and Morro Bay at any joint meeting may update the allocation of costs at any reasonable time within each year based on the records of actual use during the year. The plant manager shall each month furnish Morro Bay and Cayucos with a flow analysis of effluent flowing through the plant in the previous month, which record shall be used to determine the parties' usage and percentage of costs liability under this paragraph*".

Because we cannot isolate and measure increases in amounts of wastewater due to inflow and infiltration of the Cayucos trunk line during wet weather, we have no way to ensure that they pay the full cost of processing all of their own wastewater. In fact, the way the costs are currently measured, the more inflow and infiltration of the Cayucos trunk line, the less Cayucos pays. This is because the added flows end up being counted as part of Morro Bay's usage of the WWTP, and so, Cayucos' percentage of usage is lowered.

3. The amount of raw sewage exfiltrating from this line into the soil in North Morro Bay is also unknown. In dry weather, Cayucos pumps close to 300,000 gallons of raw sewage along north Main Street every day, and more during tourist events. Since this pollution is occurring in Morro Bay, the City may be liable.

2. Cayucos Line - Hydrogen Sulfide Emissions

Issues:

The JPA provides no means for requiring that Cayucos eliminate the problem of hydrogen sulfide gas emissions from its trunk line.

Residents have often reported a strong odor of hydrogen sulfide gas adjacent to manholes in the Cayucos trunk line down north Main Street. Hydrogen sulfide is a hazardous material. During pump cycling at Cayucos lift station 5, hydrogen sulfide gas is generated. The gas ends up venting all along north Main Street in Morro Bay.

Cayucos has made some effort to control the problem with the addition of ferrous chloride to wastewater, and the use of bio-filters, but citizens report these measures have been only partially successful.

Financial Impact:

The hydrogen sulfide emissions from the Cayucos line are occurring in Morro Bay. Morro Bay may have some liability for the air pollution caused by the emissions, as well as for any injury caused by the gas. We did not find any provisions in the JPA specifying Cayucos' responsibility for this problem.

3. Lack of Means to Control/Monitor Valve that Diverts Trunk Line Flow

Issues:

The JPA does not provide a means for Morro Bay to monitor, or adequately control, a valve that diverts flow from the Cayucos trunk line to the shared line. During a recent flow test of the shared line, those conducting the test were unaware that flow was being diverted to that line, and test results were incorrect, showing less remaining line capacity than actually exists.

In a serious case of "poor coordination", just before the Wallace Group tests of the line began, a valve was opened to divert flow from the Cayucos trunk line along Main street to the shared trunk line. The amount of flow coming through the trunk line during the test was considerably greater than normal. Had the test been conducted with the valve closed, as it should have been, test results would have been very different.

On page 5 of the JPA, is the statement: "*It is agreed that both at the present time and after the reconstructed plant is completed, Morro Bay has, and will have, a 60% capacity right, Cayucos a 40% capacity right in the common trunk line*". According to the JPA, operation, repair and maintenance of shared facilities is a joint responsibility. This would indicate that repair or replacement of the shared trunk line would be paid for by both parties.

Financial Impact:

It would seem that, since Morro Bay has a greater share of capacity of this line, Morro Bay would be expected to pay a larger share of the costs to replace the line with a larger one. Such replacement could benefit Cayucos, given the rate of development in the town, but is not likely to be of great benefit to Morro Bay in the foreseeable future. In paying a portion of the costs for replacement with a larger line, Morro Bay would be subsidizing an infrastructure to support Cayucos development.

Inability to Ensure Effective Management of Collection Infrastructure in Cayucos

1. Ineffective Collection System Maintenance Agreement

Issues

Although the JPA states that each town is responsible for maintaining its collection system, there are no effective provisions for prompt and effective enforcement. Paragraph 22, "Resolution of JPA Disputes", is not sufficient.

The inadequacy of enforcement provisions is clear in the fact that both Morro Bay and Cayucos are, and have consistently been, violating their own agreement. Had well-defined, effective enforcement procedures existed, they would have ensured an orderly, year-by-year inspection and repair process.

On page 8 of the JPA, is the statement: *"Collection Lines: With the exception of the common trunk line and ocean outfall provided for in Paragraph 5, each of the parties shall assume the full responsibility for the construction, repair, replacement, operation, and maintenance of any trunk lines and sewer collection lines within their respective boundaries."*

On page 9, is the statement: *"Each party agrees to adequately maintain the collection and trunk lines within their respective boundaries." In fact, both Morro Bay and Cayucos are violating, and have been violating for many years, this provision of the agreement."*

This is fine, but the agreement has no "teeth".

Like Morro Bay's, Cayucos' collection system is in poor condition. Deferred maintenance has resulted in a system with numerous leaks that allow inflow, infiltration, and exfiltration.

In our last report, "Damaged Lines in Morro Bay's Wastewater Collection System, Causes and Effects", we described the deplorable condition of our own lines. We know that the system in Cayucos is in no better condition and, in fact, may be even more dilapidated than ours. The full scope of the problem is difficult to precisely assess, but 2004 video camera inspections revealed significant damage in lines throughout the town.

Every year, during wet weather, there is considerable pooling and flooding in some areas of Cayucos. In fact, the Cayucos Sanitary District is violating its own ordinance regarding pooling over sewer easements. This problem has existed for some time, and contributes to inflow and infiltration which, in turn, contribute to surcharges at the WWTP.

Financial Impact:

We could fix every pipe in Morro Bay, but still have problems with WWTP surcharges due to excessive inflow and infiltration from Cayucos. Both MB and Cayucos are liable for surcharging events at the WWTP, regardless of who is at fault.

2. Use of Morro Bay Emergency Equipment and Personnel to Service Cayucos

Issues:

While mutual aid is certainly desirable in times of emergency, the JPA makes no formal provision for charging back costs for emergency use of Morro Bay equipment and personnel. Agreements covering apportionment of costs cover only jointly held facilities.

Although the JPA makes each town responsible for maintenance of its own collection system, Cayucos uses Morro Bay's emergency equipment and personnel for callouts when there are backups and overflows. Morro Bay's truck and pumps are dispatched to deal with these emergencies because Cayucos does not have adequate equipment. They do not dispatch their personnel to help in the case of similar emergencies in Morro Bay.

Financial Impacts:

1. Costs for the use of MB personnel and equipment in Cayucos are not covered adequately by formal JPA requirements for chargebacks to Cayucos.

2. When Morro Bay's equipment and personnel are occupied in Cayucos, they are not available for use in Morro Bay, potentially leaving Morro Bay short-handed and unable to respond to its own backup and overflow events. This creates the potential for fines, if a Morro Bay spill is not contained and cleaned up quickly.

Inability to Predict the Amount of Future WWTP and Trunk Line Flows from Cayucos

Issues:

The JPA contains no provisions for planning for future capacity, and the sharing and management of the resultant costs, should rapid development result in early obsolescence of the new WWTP plant and other shared infrastructure.

There is a great deal of ongoing development in Cayucos, and every reason to expect this to continue. With expectations that the town will have access to a good supply of water from Lake Nacimiento, there is every reason to expect that the town will continue to grow.

Growth means more wastewater, and thus greater risks of exceeding the capacity of the WWTP, and the shared trunk line.

Financial Impact:

When the WWTP plant currently in the planning state is built, it will be constructed to handle a specific capacity. If development in Cayucos causes the capacity of the WWTP to be exceeded sooner than expected, Morro Bay will incur costs for another new plant earlier than planned. The JPA contains no provisions to protect Morro Bay from this potential impact of development outside its boundaries.

Lack of Appropriate Formal Agreements Covering Services to the State Park

Issues:

The JPA includes no discussion of services provided to the State Park. Before the current JPA was implemented, Morro Bay agreed to provide sewage treatment services for the State Park.

At that time, wastewater flows from the park were much less than today. Over the years, the amount of wastewater from the park has increased, and includes flows not just from the RV campground, but from the museum, from the restrooms serving the marina and Bayside Café, and of course, the Inn at Morro Bay. The wastewater from the State Park is counted as part of Morro Bay's allocated usage of the WWTP.

Morro Bay has never negotiated updates to the JPA to include the State Park; thus Cayucos has never had an opportunity to approve or disapprove the Morro Bay's wastewater treatment arrangement with the State Park. Yet, they may be impacted by it.

Currently, the County-run golf course has issues with water supply, and a failing leach field. The State Park needs to address these issues with the County. Then, the wastewater entering Morro Bay's collections and conveyance system can be appropriately accounted for.

Financial Impacts:

1. The State Park wastewater contributes significantly to the potential for surcharging at the WWTP, but the Park has no official responsibility/liability for fines that may be levied due to surcharging events. Thus, Morro Bay and Cayucos could be liable for financial impacts of their "silent partner".
2. Because the State Park is not included in the JPA, but still contributes to the potential for surcharge events at the WWTP, and because this is due to arrangements made by Morro Bay, Cayucos could potentially challenge its own responsibility for paying fines associated with those events.
3. Morro Bay may be subsidizing the State Park, if the Park is not paying a fair share of ongoing WWTP maintenance and operations costs. In addition, we are unaware of any arrangement to require the Park to contribute to construction costs for the new facilities currently being designed.
4. In the event of an emergency, When Morro Bay's equipment and personnel are occupied in the State Park, they are not available for use in Morro Bay, potentially leaving Morro Bay short-handed and unable to respond to its own backup and overflow events. This creates the potential for fines, if a Morro Bay spill is not contained and cleaned up quickly

Potentially Unfavorable Terms Covering By-products of Wastewater Treatment

Issues

JPA terms covering ownership and use of wastewater treatment by-products may be unfavorable to Morro Bay, should the City decide to process reclaimed water from the WWTP in the desalination plant.

On page 17 of the JPA, it is stated that: *"By-products of treatment: any fertilizer, water, or other substance resulting from the operation of any of the joint facilities shall be deemed to be the property of the parties hereto and apportioned on a 60-40 basis."*

and,

"Either Cayucos or Morro Bay shall have the right, for its own use, to use its proportionate share of effluent, fertilizer, water, methane gas, or other substance resulting from its use without payment to the other party. Such usage limitations are to be based on actual flow."

We are unaware of any attempt to clarify or re-negotiate these provisions with regard ownership of products of desalination.

Financial Impact:

While the above statements from the JPA are somewhat confusing, it appears to us that they may indicate that Cayucos is entitled to a share of any water that Morro Bay processes in the desalination plant, regardless of whether Cayucos contributes to any of the expenses of processing.

Recommendations

Morro Bay should attempt to negotiate a new JPA with the provisions necessary to protect the City's financial interests. Paragraph 11, "Amendment or Waiver" may be a problem as both governing bodies must approve any changes to the existing agreement.

However, the current JPA was negotiated during planning for a new WWTP facility. On page 4 of the JPA, it is stated: "This is intended to be a joint owners agreement setting forth the respective rights of Morro Bay and Cayucos for purposes of the construction of the expanded wastewater treatment plant, as well as for the ownership, operation, and maintenance of said plant and appurtenant facilities"

Since we are now embarking on constructing another new plant, the timing for negotiation of a new agreement would seem ideal.

Any new or revised agreement should include the following provisions not included in the current JPA:

1. Requirement for Cayucos to maintain its Main Street Trunk line to minimize inflow and infiltration, and the emission of hydrogen sulfide gas.
2. Provisions for measuring the true amount Cayucos flow (including inflow and infiltration from the Cayucos trunk line) for which Cayucos is responsible
3. Enforcement provisions to ensure that Cayucos, Morro Bay, and the State Parks maintain their respective collection systems in a condition that minimizes inflow, infiltration, and exfiltration. These provisions should include penalties for failure to comply.
4. Requirement that Cayucos purchase and operate its own equipment for dealing with backup and overflow events.
5. Detailed provisions for addressing the impacts of new development on infrastructure capacity, including financial responsibility of the parties for covering costs associated with increased loads, resulting from development, on jointly-held facilities .
6. Arrangements with, and financial responsibilities of the State Park, including coverage of the cost of additional emergency equipment and personnel, as necessary to ensure that Morro Bay has adequate coverage at all times.
7. Definition of ownership of any reclaimed wastewater processed in the desalination plant.

At one filmed Cayucos Sanitary District Board meeting, a Board member stated: "Morro Bay is asleep and that's just the way I like it. We don't want to wake them up". The gentleman may have been joking, but this is no laughing matter. Morro Bay does need to wake up, and understand the risks inherent in the current JPA. To protect Morro Bay's financial interests, and ensure that the City pays its fair share of the WWTP system costs, and no more, the JPA must be revised.

Condition of the Morro Bay Wastewater Collection System

Video Inspection Review and Analysis

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Introduction

We have conducted an independent review of a sample of videotapes, and, where available corresponding written logs chronicling the inspections of approximately 1.4 miles of various wastewater collection system lines in Morro Bay. We also reviewed a sample of logs for tapes that we did not view. Those logs cover inspections of approximately 1.89 miles of collection lines.

Our findings, documented in this report, include hundreds of defects, most of which are, or indicate the presence of, openings in the pipes. These openings are identified in various logs as offsets, separations, dislocations, cracks, joint openings, broken joints, chips, structural damage, holes, and root intrusions (an opening must be present for roots to enter a line). The data presents clear and irrefutable evidence that much of, and probably nearly all of, the City's collection system is in a shocking state of disrepair.

As noted in an earlier report, openings in the pipes permit infiltration of water into the system in wet conditions, and exfiltration of raw sewage into the soil when the soil surrounding the lines is dry. The pipe damage documented in this report makes it clear that serious pollution of our soil by untreated sewage is going on all over the City. In addition, Morro Bay is paying for the processing of large amounts of rainwater/runoff that enter the system in wet weather.

The taped inspections and logs we reviewed are from a variety of areas, indicating the very widespread nature of the problem. Given that this review covered only a sample of the total collection system, we believe it is clear that the problem is extremely serious. We have no doubt that additional inspections would uncover more of the same – a completely dilapidated system that is dangerous to our health, and to the environment.

Process

Sample

We chose a sample of videotaped inspections and logs to review. Some of the tapes had corresponding logs done by contractors, and some of the other logs were reviewed on a standalone basis (the corresponding tapes were not viewed). The sample tapes and logs cover inspections of lines in a variety of areas of the City, including downtown, lower Morro Heights, the Beach Tract, several sections of North Morro Bay, east of the highway, a section of Atascadero Road, and major portions of the Main Street Trunk Line.

Tapes:

The City made 30 tapes and 3 DVD's available to us, along with all of the logs available for the taped records. We chose 6 of the tapes for our sample. In total, we reviewed and logged defects in approximately 7,390 feet, or approximately 1.4 miles, of line.

Logs

The additional logs we reviewed (for which we did no corresponding reviews of videotaped records) cover a total of 9,991 feet, or 1.89 miles.

Methodology

- We viewed all of the sample tapes and logged, in detail, all visible damage to the pipes, and the presence of debris, grease (generally this is from restaurants) and roots. The tapes were viewed by three Morro Bay citizens. One, who is a certified CWEA Grade IV Wastewater Collection System Operator, was responsible for identifying the defects; the other two were responsible for logging them.
- We logged all defects, even when we considered them minor. We did this because the impact of multiple minor defects will be the same as the impact of one larger one, and because, due to the fact that soil movement tends to continue, small defects can generally be expected to grow into larger ones. Copies of our logs were provided to Senior Civil Engineer Dylan Wade, of the City's Public Works Department.
- For all logs that were created during this review, we summarized the system damage according to type. We documented the summaries in "log sets" that correspond to videotapes. Figures from the log set summaries from our logs were rolled up into overall totals.
- A small portion of one tape we viewed, created in the year 2007, duplicated material on another, dated 2000. We adjusted our defect totals to avoid "double counting" of defects, and compiled data showing the increase in defects over the 7-year period. We also noted one particularly severe and dangerous defect seen in the 2007 tape that existed in 2000, but was never repaired.
- For portions of two tapes that we viewed and created logs for, a set of logs already had been done by the inspection companies. We compared their logs to ours, and identified the differences. Because of discrepancies between our logs, and the inspection companies', we compiled and documented comparisons of the corresponding logs.
- We also reviewed inspection logs provided for additional tapes/DVD's that we did not view. Although prior analysis told us that these logs might not include records of all actual defects in the lines inspected, we transcribed and summarized the data, and included it in this report to give a general idea of the condition of lines in the areas covered.

Findings

The tapes and logs that we reviewed provide irrefutable evidence that the Morro Bay wastewater collection system is in a serious state of disrepair. There are hundreds of defects, many of them major, in the collection lines included in the inspection tapes and logs we reviewed. Because our sample came from a variety of areas of the City, because most of the system is old, and because of many years of deferred maintenance, we believe it is reasonable to assume that most of the system is in similar condition.

Frequency of Occurrence of Pipe Defects Seen on Tapes we Viewed

Table 1, below, provides a summary of findings from the tapes we viewed.. Please see Appendix A, Inspection Log Summaries, for the source data for this table.

Table 1: Findings From Independent Review of Sample Tapes

Type of Defect/Problem	Total # of Occurrences
Offset Joints	589
Separated Joints	163
Dislocated joints	16
Cracked areas	59
Major breaks	2
Root Intrusion in joints	About 369 feet of pipe affected
Significant structural damage*	2
Bellies/Dips (sagging pipes)	45
Areas of debris	8
Areas of grease buildup	11 (7 are in sewer main connections)
Areas of significant H ₂ S gas	6
Bad lateral connections	5
Areas where lateral connections are too close together	1
Manholes with missing pan	2

*type unspecified

These figures are intended to give a picture of the various types of defect present in the lines we reviewed. In some cases, multiple defects are present at one pipe joint, or in one area of a pipe. For example, we might have an offset and separation at one joint, or a crack and root intrusion in one section of a pipe. Therefore, the total number of defects is not representative of the total number of points in the lines where there are defects. For example, at 49 joints, we found both offset and separation. Still, these numbers are high enough to be very alarming. Any offset, separation, diskocation, crack, or break can, depending on its location and other conditions, present the risk of raw sewage leaking into the soil.

If we look only at offset joints, we find that, given our totals of 589 offsets, with 7,390 feet of pipe inspected, we have on average an offset joint every 12.5 feet.

If we now take the number of separated joints, 163, and adjust for the fact that 49 joints have both separation and offset, we now have 114 more defective joints.. Adding this figure to the 589 joints with offset, we now have a total of 703 defective joints. Now, given our total 7,390 feet of pipe inspected, we have an average of one defective joint every 10.5 feet. **Every 10.5 feet, on average, we have the potential for, depending upon conditions, inflow and infiltration (I&I) and/or exfiltration – the leakage of raw sewage into the soil.**

Were we to continue the calculations, figuring in dislocated joints, cracked areas, major breaks, and bad lateral connections, the average distance between pipe defects would be shorter than just this distance between defective pipe joints, as not all defects occur at a joint..

Deterioration of a Section of the Main Street Trunk Line Over a Seven-Year Period

For one section of the Morro Bay Trunk Line, running from manhole 73 to 3, a distance of about 770 feet, we viewed an inspection tape made in 2000, and another made in 2007. Thus, we were able to observe deterioration of the line over a seven year period. Manhole 73 is located at Main and Island streets, followed, to the south, by manholes 1, 2, and 3. Table 2, below, compares the defects found in the tape made in 2000 with those found in the tape made in 2007.

Type of defect	2000	2007
Offset joints	39 (1 a sunken main)	68 (one a sunken main)
Separations	5	11
Cracks	2	10, most severe
Bellies	1	4
Connections with grease	1	
Extended areas of grease (in portion of line under Alva Paul Creek)	1	1
Areas of debris		1
Manholes with missing pan		1

One can clearly see that the number of defects increased significantly over 7 years – a fact that is not surprising, due to the fact that continued sinking of the soil, probably due in large part to the sunken main connection, would have directly caused more offsets, separations, and cracks.

Sunken Sewer Main Dumping Contents Under, Not Into, Main Street Trunk

The sunken main connection noted above is particularly troubling. In both the 2000 and the 2007 tapes of the section of the Trunk Line between manholes 1 and 2; the sunken connection, which is about fifty feet north of manhole 2, was very visible. It was also logged by the contractor who created the Morro Bay log of the 2000 tape. He listed it as, "lateral broken, dirt evident/defective connection". In both tapes, the main was obviously dumping its contents UNDER, rather than into the Main Street trunk. This main serves an area of North Morro Bay between Alva Paul Creek and Sequoia. We have submitted a request to the City attorney for information that will allow us to estimate the total amount of sewage this represents. When that information is received, and our investigation is complete, we will issue a supplemental report. However, we can initially predict that the area with lines that feed into this main will include dozens of homes.

Discrepancies Between Our Logs and Those Done For/By the City

In two cases, logs we created corresponded to logs of sections of the same tapes that had previously been logged for the City, either by contractors, or by City employees. We found that our logs included significantly more defects than those done for/by the City. We are unsure as to why this would be the case, but possibly, the person doing the City logs had limited experience in spotting certain types of defects. A comparison of one of our logs, to the City's corresponding log, may be viewed in [Appendix B](#).

Frequency of Occurrence of Pipe Defects Noted in Logs we Reviewed

In order to provide information about the condition of lines in areas of the City for which we did not review tapes, we have included here a summary of the defects noted in logs done by contractors.

- Table 3 cover lines in North Morro Bay, on the east side of Highway 1, and in the Beach Tract.
- Table 4 covers lines in the Beach Tract
- Table 5 covers lines in downtown Morro Bay, lower Morro Heights, and a section of Ironwood Ave.,

These three tables cover a total of 9,991 feet, or 1.89 miles. **The average, for all three tables, is one defect that may potentially allow I&I and/or exfiltration every 17.97 feet.**

Totals for these logs were NOT counted in figures that appear in Table 1, as that table covers only our own, independently done logs.

Table 3: Contractor Logs, North Morro Bay and Beach Tract

Type of Defect/Problem	Total # of Occurrences
Offset Joints	65
Broken Joints	2
Cracked areas	27
Holes	2
Root Intrusion in joints	Nearly every joint for 180 feet – about 36 joints
Chipped areas	3
Bellies/Dips (sagging pipes)	10
Areas of debris	11
Areas of grease buildup	1

The 22 inspections included in Table 3 cover 4,498 feet of pipe, about .85 mile, and are from Morro Bay Log Set 1, in Appendix A.. If we total offset joints and broken joints, we have a total of 67 defective joints. Because root intrusion implies a damaged joint, we may also add the approximately 36 joints thus affected, giving a total of 103 defective joints. **This implies, on average, one bad joint, which may permit I&I and/or exfiltration for every 43.7 feet of line.** As previously stated, some defects might or might not occur at joints. If the cracks, chips, and holes cited here do not, then we have a total of 135 defects and an average of **one pipe defect that may permit I&I and/or exfiltration every 33.3 feet.**

Type of Defect/Problem	Total # of Occurrences
Offset joints	19
Joint openings	2
Cracked areas	19
Root Intrusion in joints/laterals	41
Bellies/Dips (sagging pipes)	1

The 8 inspections included in table 4 cover 1,352 feet of pipe, about .26 mile, and are the first 8 items from Morro Bay Log Set 1.. If we total offset joints and open joints, we have a total of 21 defective joints. Because this contractor did not specify the type of opening that permitted root intrusion, we will assume that the opening is an offset, a separation, or both. Adding in the 41 joints with root intrusion, we now have a total of 62 bad joints, 2 being joints of the main with laterals. Dividing 1,352 by 62, **we have, on average, a bad joint, which may permit I&I and/or exfiltration, every 21.8 feet.** As previously stated, some defects might or might not occur at joints. If the cracks cited here do not, then adding in the 19 cracked areas, we have a total of 81 total defects. Dividing 1,352 by 81, **on average, we have a pipe defect that may permit I&I and/or exfiltration every 16.7 feet.**

Type of Defect/Problem	Total # of Occurrences
Offset joints	18
Cracked areas	7
Root Intrusion in joints/laterals	315
Bellies/Dips (sagging pipes)	3
Areas with grease	4
Areas with debris	2

The 20 inspections included in table 5 cover a total of 4,245 feet of pipe. One page of one log, covering 104 feet, was missing from the materials we received, and so we saw logs for, and will address problems found in the remaining 4,141 feet. – approximately .78 mile. Again, the contractor did not identify the type of joint opening that allowed root intrusion, and again, we will assume that the opening is an offset or separation. Here, we have a total of 333 defective joints. Dividing 4,141 by 333, **we have, on average, a defective joint that may permit I&I and/or exfiltration every 12.44 feet.** As previously stated, some defects might or might not occur at joints. If the cracks cited here do not, adding in the 7 cracked areas, we have a total of 340 defects, and **on average, a defect that may permit I&I and/or exfiltration, every 12.18 feet.**

Conclusions and Recommendations

The Morro Bay wastewater collection system is in very poor condition,. Ongoing impacts of this problem include:

- **Exfiltration of raw sewage into the soil**
 - **Pollution of groundwater**
 - **Pollution of the Bay, and the Ocean**
 - **Flood control and drainage issues**
- **Infiltration and inflow of water into the system during wet conditions**
 - **Surcharging**
 - **Reduced system capacity**
 - **Higher processing costs**

There are so many defects that allow exfiltration that it could be said that much of Morro Bay is functioning as an enormous leach field for sewage. Leach fields, when constructed with proper filtering materials, in sufficient amounts for the volume of sewage to be treated, are not a bad thing. However, the soil under our streets and properties is not intended to function as a leach field, and the pollutants in the sewage are most certainly reaching our groundwater, our creeks, the Bay, and the ocean. Every home or other structure that includes toilet facilities is potentially contributing to this pollution, which presents a serious risk to health, safety, and the environment.

The Morro Bay East Estuary State Marine Reserve was implemented on September 21, 2007. The Marine Protection Act, by which the State marine Reserve is mandated, forbids the "take"; disturbance or alteration of living marine organisms within.

Morro Bay and the Morro Bay Power Plant, along with Los Osos, SLO County, the Morro Bay Harbor Department, Fish and Game, and State Parks are going to be held accountable for any violations of the Marine Protection Act. Concerned citizens and those responsible for the administration of these entities need a collaborative effort to solve the water pollution problem with respect to the State Marine Reserve. The City needs a biodiversity action plan (BAP).

It must also be noted that Assembly Bill 1066 requires local governments to consider the impacts of sea level rise when preparing and amending a local coastal program. The current changes in our coastal policies must be taken seriously and incorporated into any project that the City undertakes. Obviously, this includes the upgrade, repair, and replacement of wastewater collection infrastructure, and is particularly significant in terms of the location of the Wastewater Treatment Plant.

We are aware of recent discussions in which primary reasons for the decision not to build a fire station at the intersection of San Jacinto and Highway 1 were that site's location in 100-year and 500-year flood plains, and the risk of tsunami inundation. Yet, the location of the current Wastewater Treatment Plant, and for the new facility, is almost exactly the same distance from the ocean, and only a short distance south of the rejected fire station site. The existing location of the Plant would require a containment wall to be built to keep sea water out, and sewage in. this is obviously neither a viable long-term or short-term solution.

The severity and urgency of Morro Bay's pollution problem, and of the need for intelligent, well-planned infrastructure repair and replacement, cannot be over-emphasized.

We recommend that the following actions be taken immediately:

1. **Institute an immediate ban on all new construction:** This includes all parties that use and contribute sewage to the Morro Bay collection and conveyance system: the City of Morro Bay, the Cayucos Sanitary District, the County-run golf course, and California State Parks facilities. This ban should remain in effect until the corresponding collection and conveyance system infrastructure is repaired and/or replaced.
2. **Determine repair/replacement priorities and costs:** Hire a consultant (team) to identify the areas of concern that pose the most serious public health and safety risk. Their work would include conducting new video inspections of collection system lines, identification and prioritization of areas of highest concern, and development of estimates for repair costs.
3. **Investigate a regional solution for wastewater treatment.** With the County taking the lead, Morro Bay, Cayucos, the Morro Bay golf course, State Parks, and Los Osos can address water supply and wastewater treatment issues with a regional plan – a plan that would protect the new Morro Bay East Estuary State Marine Reserve with a sustainable, expandable, and affordable wastewater treatment solution. A holistic solution will maximize health and safety, and minimize cost

This type of wetlands restoration project is currently being undertaken for the town of Petaluma by Corrolo Engineering. Because Morro Bay is already working with that engineering firm, information would be readily available to our City government.

4. **Investigate alternative locations for the Wastewater Treatment Plant.** As part of the process of repairing and replacing the infrastructure, address the serious risks inherent in the current location of the Morro Bay Wastewater Treatment Plant. Open discussions with the County of San Luis Obispo, and with all users of the treatment facility, regarding moving the Plant away from the beach.
5. **Hire a consultant to assist in finding new sources of funding.** Additional funding is needed so that correction of problems in the collection system can be accelerated. The current 3-year timeframe is, in our opinion, too long, and will allow for far too much pollution to occur before necessary repairs are complete. Potential sources of funding include:
 - a. **Prop. 84,** Funds projects relating to emergency safe drinking water, water quality flood control, and beaches. Prop 84 makes available \$5.4 billion, raised through bonds.
 - b. **Prop 50.:** Administered by the State Water Boards, Proposition 50 funds projects that address water quality and the supply of safe drinking water. It also provides coastal wetlands purchases, something that would be needed for a regional plan for wastewater treatment. Prop 50 makes available \$3.5 billion, raised through bonds, and repaid from State General Fund).
 - c. **Possible Joint Project with Chevron and/or PG&E.:** These firms may be interested in the fact that a wetlands restoration project provides the most efficient CO₂ sequestering. By helping to fund a wetlands project, they will be eligible for global greenhouse gas credits.
6. **Develop a biodiversity Action Plan (BAP).** In the current political and environmental climate, there is a need for a sustainable, expandable, and affordable solution for water supply and treatment. This could be addressed by the Blue Carpet water treatment plan. Basically, this plan would utilize the internationally recognized BAP program for the Morro Bay Estuary and its State Marine Reserve, integrating:
 - A sustainable wetlands restoration project
 - Support and Protection of bird and other endangered species habitat
 - Resolution and management of water supply and water treatment issuesfor all of the communities of Estero Bay. Let's roll out the blue carpet for our future generations.

Appendices

Appendix A : Inspection Log Summaries

Please note that these Summaries are supported by complete, detailed logs detailing the locations of the defects identified. Copies of those logs are available upon request.

Independent Logs - Set 1

The following 20 inspection logs are contained in a single document, dated September, 2007, written by the authors of this report

Note that these logs correspond to logs done for the City by a consulting firm, included in this document as MB Logs, Set 1.

Areas of Morro Bay Included:

This set of logs includes inspections of a section of the Main Street Trunk line, lines in North Morro Bay, east of Hwy 1, and a section of line along Kern Avenue.

Summary of Findings for This Set of Logs

These 8 inspections cover about 1,675 feet of pipe, about .32 mile

Problems identified in this set of logs include:

- **Roots in joints of approximately 330 feet of pipe**
- **168 offsets**
- **73 separated joints**
- **24 areas with cracking**
- **9 dislocated joints**
- **3 areas with debris**
- **1 major break**
- **1 large area of grease buildup**
- **4 bad lateral connections**
- **1 area where 2 lateral connections are too close together (weakens pipe)**
- **5 bellies**
- **2 manholes with pan missing (pan reduces I&I)**

We noted that the logs done for the City, MB Logs, Set 1, contained significantly fewer notations of damage than did these.

Summaries by Log

1. Main south of Island, Corresponds to MB Logs, Set 1, item 9.

2 offset joints

1 crack

1 major break and dislocation with radial cracking

1 area of heavy grease, extends about 15 feet

2 areas of debris, one of which stopped the camera

2. Main at Jamaica, going south, manholes 69 → 73 Corresponds to MB Logs, Set 1, item 10

Roots at most joints from 23 feet to 163 feet
9 offset joints
2 cracks
1 offset joint with separation and radial crack
5 joint dislocations, 1 major
6 joint separations
1 belly

3. Alva Paul Creek to Sequoia, manhole 1 → 3, Corresponds to MB Logs, Set 1, item 11

61 offset joints, some severe (1 a sunken main)
6 separated joints
5 joints with separation and offset
9 Cracks, most are severe
4 bellies
1 manhole with pan missing

4. Easement between Preston Lane and Little Morro Creek Corresponds to MB Logs, Set 1, item 12

Roots in several joints
18 offset joints
2 joints with offset and separation
1 separation
2 poorly connected lateral lines
1 area with multiple cracks, piece of line appears ready to come loose

5. Koa, Conejo to San Juan, manhole 32 → 33 Corresponds to MB Logs, Set 1, item 13

10 offsets, 2 major, 4 minor
1 minor separation
2 joints with offset and separation

6. Laurel south from Avalon, manhole 76 – 76B Corresponds to MB Logs, Set 1, item 14

Roots in joints in about half of the pipe; two large root balls
11 offsets, 3 major, 2 minor
3 separations
1 area of cracking
1 dislocation
2 lateral connections too close together (weakens pipe), 1 dislocated, 1 plugged
1 large piece concrete debris

7. Kern, manhole 9 → 7 Corresponds to MB Logs, Set 1, item 15

Roots in most joints
23 offsets, 3 major, 1 minor
2 separations
5 areas with cracking, several severe, multiple cracks, 2 with piece of pipe loose
2 bad lateral connections
2 dislocated joint

8. Kern, manhole 7 → 9, going south Corresponds to MB Logs, Set 1, item 16

Roots at most joints, from 58 feet on, severe in several areas; 1 area where 80% of pipe is filled
24 offsets, 6 minor
33 separations, 2 major
1 joints with offset and separation
3 areas with cracking, one with piece of pipe loose, looks as if it could come out
2 bad lateral connections
1 manhole with missing pan

Independent Logs - Set 2

The following 28 inspection logs are contained in a single document, dated September, 2007, written by the authors of this report

Note that these logs correspond to logs done for the City by a consulting firm, included in this document as MB Logs, Set 2.

Areas of Morro Bay Included:

.This set of logs includes inspections of the Main Street trunk line from manhole 20 to manhole 56

Summary of Findings for This Set of Logs

These 28 inspections cover about 4877 feet of pipe, about .92 mile

Problems identified in this set of logs include:

- **Roots in joints of approximately 38 feet of pipe**
- **396 offsets**
- **88 separated joints**
- **15 areas with cracking**
- **7 dislocated joints**
- **1 major break**
- **8 sewer main connections with grease buildup**
- **1 large area with grease buildup**
- **1 bad lateral connections (sunken sewer main)**
- **36 bellies**
- **6 areas of H₂S gas**

We noted that the logs done for the City, MB Logs, Set 2, contained significantly fewer notations of damage than did these.

Summaries by Log

1: Main, starting at Zanzibar, manhole 20 → 21 136 foot pipe

6 offsets, 2 of them at sewer main connections

Roots at one of the offset joints

1 major belly

2: Main, starting at Yerba Buena, manhole 21 → 25 45 foot pipe

2 offsets, one minor

1 probable major belly (camera underwater for some distance)

3: Main, manhole 25 → 26, foot counter not reset 158 foot pipe

8 offsets, 1 major, 6 minor

10 separations

1 crack

2 areas with roots

1 belly

1 area of H₂S gas

4. Main, manhole 26 → 27, counter was reset 143 foot pipe

8 offsets, 6 minor

7 separations, 6 minor

- 2 areas with roots
5. Main, manhole 27 → 31, counter was reset 165 foot pipe
5 offsets, 4 minor
1 separation
1 belly
6. Main, manhole 31 → 34, counter was reset 165 foot pipe
4 minor offsets, one in sewer main connection
7. Main, manhole 34 → 37, counter was not reset 167 foot pipe
8 minor offsets
8. Main, manhole 37 → 40, counter was not reset 168 foot pipe
12 offsets, 7 minor
1 minor separation
9. Main, manhole 40 → 43, counter was not reset 170 foot pipe
17 offsets
1 break/crack
1 area H₂S gas
5 areas of exfiltration
10. Main, manhole 43 → 46, counter was reset 163 foot pipe
4 offsets
1 joint with offset and separation
11. Main, manhole 46 → 49, counter was not reset 167 foot pipe
10 offsets, 1 minor
2 cracks
5 areas of exfiltration
2 bellies
12. Main, manhole 49 → 54, counter was not reset 165 foot pipe
6 offsets, 1 minor
1 belly
1 crack
13. Main, manhole 54 → 57, counter was not reset 168 foot pipe
7 offsets
6 separations
3 dislocations
3 areas with roots, 1 major
1 belly
14. Main, manhole 57 → 60 167 feet
9 offsets, 1 major
1 large crack
2 areas of exfiltration
2 bellies
15. Main, manhole 60 → 63, counter was not reset 165 foot pipe
15 offsets
1 crack
7 areas of exfiltration
2 bellies
16. Main, manhole 63 → 66, counter was not reset 170 foot pipe
11 offsets
1 separation
1 cracked sewer main connection
2 bellies
5 areas of exfiltration
17. Main, manhole 66 → 69, counter was reset 165 foot pipe
15 offsets, 1 major
1 joint with offset and separation
5 areas of exfiltration

- 1 belly
- 18: Main, manhole 69 → 72, counter was not reset 168 foot pipe
 - 11 offsets
 - 16 separations
 - 17 areas with roots
 - 2 bellies
- 19 Main, manhole 72 → 73
 - Tape of this segment of the line is damaged. Cannot see anything
- 20 Main, manhole 73 → 1 counter not reset cannot estimate length due to problems with last segment problems noted here cover about 20 feet total
 - 2 offsets
 - 1 area pipe damage (crack?)
 - 1 long stretch of heavy grease (corresponds with what contractor said was rust)
- 21 Main, manhole 2 → 3 counter reset – reported damage on 230 feet of pipe, then counter went out.
 - 14 offsets
 - 1 separation
 - 4 joints with offset and separation, 1 minor; 1 of the offsets major
 - 1 connection with minor grease
 - After 230 feet – camera gets stuck, then counter stops. After the camera is freed, it continues, but the operator failed to start up the counter again, so we cannot report location of additional damage. We did see more offset joints, a belly, and major exfiltration and infiltration from Alva Paul creek, as well as grease
- 22 Main, manhole 1 → 2 counter reset 372 foot pipe
 - 18 offsets, 4 minor
 - 1 joint with separation and offset
 - 1 crack
 - 2 areas exfiltration
 - 1 sewer main that has sunk so far it is dumping its entire contents UNDER the trunk line
 - 3 bellies
 - 1 area H₂S gas
- 23 Main, manhole 3 → 9 counter reset 342 foot pipe
 - 35 offsets, 6 minor, 3 major
 - 4 joints with offset and separation
 - 3 cracks, 2 major, 1 cracked area with piece of pipe loose
 - 5 bellies
- 24 Main, manhole 9 → 10 counter reset 343 foot pipe
 - 31 offsets, 8 minor, 2 major
 - 3 joints with offset and separation, 1 minor
 - 3 joints with offset and dislocation
 - 1 sewer main connection with I&I
 - 1 small longitudinal crack
 - 2 sewer main connections with infiltration
 - 1 sewer main connection with grease
 - 4 areas of H₂S gas
 - 1 belly
- 25 Main, manhole 10 → 11 counter reset 342 foot pipe
 - 32 offsets, 5 minor
 - 2 sewer main connections with infiltration
 - 3 areas of exfiltration
 - 3 bellies
 - 1 area H₂S gas
- 26 Main, manhole 12 → 11 counter reset going upstream, against flow 346 foot pipe
 - 28 offsets, 1 major, 1 minor
 - 21 joints with offset and separation
 - 2 sewer main connections with grease, 1 major
 - 1 area of roots

2 bellies

283 feet – camera then goes underwater, counter is not working. Cannot record further damage due to counter malfunction

27 Main, manhole 12 → 55 counter reset 345 foot pipe

29 offsets, 2 minor

4 joints with offset and separation

1 crack

2 sewer main connections with grease

9 areas with roots, 1 major

28 Main, manhole 55 → 56 counter reset 344 foot pipe

24 offsets, 2 minor, major

2 joints with offset and separation

5 separations

1 longitudinal crack at 12 o' clock, major infiltration

5 areas of roots

2 sewer main connections with grease, 1 major

multiple bellies – camera goes under water over and over.

Independent Logs - Set 3

The following 20 inspection logs are contained in a single document, dated September, 2007, written by the authors of this report.

These logs do NOT correspond to any Morro Bay logs included in this document. To our knowledge, no logs of this tape were done by Morro Bay

Areas of Morro Bay Included:

Main Street trunk line from Hwy 41 to WWTP, metering manhole, Atascadero Road

Summary of Findings for This Set of Logs

These 5 inspections cover a total of 889 feet of pipe, about .17 mile.

Problems identified in this set of logs include:

- **Roots in 1 area**
- **25 offset joints**
- **2 separated joints**
- **10 cracked areas**
- **2 areas of significant structural damage** (type unspecified)
- **35 areas of I&I, many severe. Pipe appears to be below water table**
- **5 areas of debris**
- **3 areas of grease buildup**
- **7 bellies**
- **1 area where H₂S gas is visible**

Summaries by Log

1. Main Street Trunk line between corp yard and 30" trunk, 17 foot pipe

1 Severe offset with severe I&I; camera could go no farther

2. Main Street Trunk, starting at Highway 41 and Main, going south – 327 foot pipe

- 1 area of debris and severe grease buildup; grease continues 78 feet.
- 1 root ball
- 2 offsets - 1 minor
- 4 areas of I&I at joints
- 1 belly
- 1 evidence of surcharge about 10 feet up into manhole
- 1 area where H₂S gas is visible

3. Metering manhole – appears in good condition, no problems noted

4. Main Street Trunk line, manhole 2 → 4, 140 foot pipe

- 1 offset joint. Line appears flat here

5. Atascadero Road, 405 foot pipe

- 22 offset joints
- 2 separated joints
- 29 areas of I&I, many severe, with very large amounts of water entering the pipe
- 10 cracked areas
- 2 area of significant structural damage, 1 possibly from earthquake
- 6 bellies
- 5 areas of debris
- 3 areas of grease buildup

MB Logs - Set 1

The following 20 inspection logs are contained in a single document, dated January 18, 2007, done by Video Inspection Specialists, Inc.

Note: We did an independent review of the same videotape, and compiled our own logs. Those are contained in this document, under the heading, Independent Logs – Set 1.

Areas of Morro Bay Included:

This set of logs includes inspections of pipes in North Morro Bay, east of Hwy 1, and the Beach Tract.

Summary of Findings for This Set of Logs

These 16 inspections cover a total of 2,962 feet of pipe, about .56 mile.

Problems identified in this set of logs include:

- **Roots in most joints for a total of about 600 feet.- about 123 joints**
- **39 offset joints**
- **38 cracks**
- **1 area described as “crushed”**
- **2 joint openings (separations)**
- **3 dips**
- **1 hole**
- **1 possibly tuberculated area**

We noted that our logs (Independent Logs – Set 2) included significantly more notations of damage.

Summaries by Log

1. Blanka between Panorama and Tuscan, 275 foot pipe, manhole 10 → 10A

Roots at 4 joints,
3 offset joints, one severe

2. Orcas between Tide and Panorama, 152 foot pipe, manhole 44 → 44A

Roots in one area
8 offset joints, one severe, one major

3. Beachcomber between Luzon and Kodiak, 128 foot pipe, manhole 24 → 23

3 offset joints
1 dip
Area where pipe bends upward; then downward, over run of about 16 feet

4. Beachcomber between Luzon and Kodiak, 122 foot pipe, East structure → manhole 24

1 offset joint

5. Sandalwood between Sienna and Terra, 64 foot pipe, manhole 60 → 59

Roots at 20 joints, 2 laterals
6 cracks

6. Coral between Sienna and Terra, 336 foot pipe, manhole 59 → 60

Roots in 6 joints, 1 lateral
3 offset joints
7 cracks; in of the 7 areas, notes say “longitudinal crack in pipe – multiple”
1 joint opening

7. Coral between Sienna and Terra, 76 foot pipe, manhole 59 → East structure

Roots at 9 joints, 2 laterals

1 offset joint

1 crack

8. Sandalwood between Verdon and Azure, 199 foot pipe, manhole 67 → 70

Roots In 1 area

7 Cracks, 5 described as "longitudinal, continued down line"

1 joint opening

Possible repair area, half concrete, half wood

9. Main, just south of Island, 98 foot pipe, manhole 73 → 1 Corresponds to Independent Logs, Set 1, item 1.

1 offset joint

1 possibly tuberculated area

1 hole

1 break, with offset major enough to stop camera from passing

10. Main, from Jamaica, heading south, 225 foot pipe, manhole 69 → 73 Corresponds to Independent Logs, Set 1, item 2.

Roots at most joints 9 feet to 174 feet

2 cracks

11. Main between Alva Paul Creek and Sequoia, 725 foot pipe, manhole 1 → manhole 3 Corresponds to Independent Logs, Set 1, item 3.

2 offset joints, 1 major

9 cracks

2 dips

12. Easement between Preston and Little Morro Creek Road, 80 foot pipe, manhole 30 → 30A Corresponds to Independent Logs, Set 1, item 4.

Roots at 3 joints

8 offset joints

1 crack

13. South on Koa from Conejo to San Juan, 88 foot pipe, manhole 32 → 33 Corresponds to Independent Logs, Set 1, item 5

Roots at one joint

14. South on Laurel from Avalon, 60 foot pipe, manhole 76 → 76B Corresponds to Independent Logs, Set 1, item 6.

Roots at 5 joints

3 offset joints

15. North on Kern Avenue, 127 foot pipe, manhole 9 → 7 Corresponds to Independent Logs, Set 1, item 7.

Roots at almost every joint

6 offset joints

4 cracks

1 area with multiple cracks, described as "crushed"

16. South on Kern, 272 foot pipe, manhole 7 → 9 Corresponds to Independent Logs, Set 1, item 8.

Roots at almost every joint from 58 feet, on

1 crack

1 dip

MB Logs - Set 2

The following 20 inspection logs are contained in a single document, dated April 19, 2000, done by Simon Sewer Maintenance

Note: We did an independent review of the same videotape, and compiled our own logs. Those are contained in this document, under the heading, Independent Logs – Set 2

Areas of Morro Bay Included:

This set of logs includes inspections of sections of the Main Street Trunk line in North Morro Bay

Summary of Findings for This Set of Logs

These 28 inspections cover a total of 4877 feet of pipe, about .92 mile.

Problems identified in this set of logs include:

- Roots in 5 joints
- 10 offset joints
- 8 cracks
- 7 pipe sags/bellies
- 1 “heavily rusted” area across creek (independent review identified this as grease, not rust)

We noted that our logs (Independent Logs – Set 2) included significantly more notations of damage

Summaries by Log

1. Main, manhole 20 → 21

1 offset at service connection

2. Main, manhole 21 → 25, counter reset

Note that pipe is Unpassable at 45.7 feet

3. Main, manhole 25 → 26, counter not reset

1 offset joint

1 area of roots

Notation that manhole 25, discovered in a field, needs to be raised.

4. Main, manhole 26 → 27, counter reset

Manhole 26 no insert

5. Main, manhole 27 → 31

No defects noted

6. Main, manhole 31 → 34, counter reset

No defects noted

7. Main, manhole 34 → 37, counter not reset

No defects noted

8. Main, manhole 37 → 40, counter not reset

1 joint with possible, slight infiltration

9. Main, manhole 40 → 43, counter not reset

2 crack/broken pipe

10. Main, manhole 43 → 46, counter reset

No defects noted

11. Main, manhole 46 → 49, counter not reset

2 cracks

12. Main, manhole 49 → 54, counter was not reset

No defects noted

13. Main, manhole 54 → 57, counter not reset

3 areas with roots, 1 in connection

14. Main, manhole 57 → 60, counter reset

1 pipe sag

15. Main, manhole 60 → 63, counter not reset

1 crack

- 16. Main, manhole 63 → 66, counter was not reset
1 sewer connection with minor drips
- 17. Main, manhole 66 → 69, counter reset
No defects noted
- 18. Main, manhole 69 → 72, counter not reset
3 joints with minor roots
- 19. Main, manhole 72 → 73, counter not reset
No defects noted
- 20. Main, manhole 73 → 1 counter not reset
cast iron pipe across creek, heavily rusted above flow line, unpassable
- 21. Main, manhole 2 → 3 counter reset
1 crack
- 22. Main, labeled manhole 2 → 3, actually 1 to 2 counter reset
1 offset
1 lateral broken, dirt evident/defective connection
- 23. Main, manhole 3 → 9 counter reset
1 offset joint
- 24. Main, manhole 9 → 10 counter reset
1 service connection with possible I&I, medium
- 25. Main, manhole 10 → 11 counter reset
1 area, 10 feet long, camera underwater
- 26. Main, manhole 12 → 11 counter reset upstream
2 offset joints, 1 with possible I&I
1 service connection with possible I&I
2 areas camera underwater
- 27. Main, manhole 12 → 55 counter reset
1 area with roots
- 28. Main, manhole 55 → 56 counter reset
2 offset joints
2 cracks
3 bellies

MB Logs - Set 3

The following 20 inspection logs are contained in a single document, dated June 18, 19, 2007, done by Video Inspection Specialists, Inc.

We did not review the tape covered by this set of logs, so there are no corresponding independent log sets.

Areas of Morro Bay Included:

This set of logs includes inspections of pipes in North Morro Bay, east side of Hwy 1, and Beach Tract.

Summary of Findings for This Set of Logs

These 22 inspections cover 4,498 feet of pipe, about .85 mile.

Problems identified in this set of logs include:

- **Roots in almost every joint for a total of about 180 feet – approx. 36 joints**
- **65 offset joints**
- **2 broken joints**

- 27 cracks
- 3 chipped areas, one of them a joint
- 11 areas of debris, two of which are sand
- 2 holes
- 10 dips
- 1 area of grease

Summaries by Log

1. Cuesta Avenue from Maple and Laurel, 282 foot pipe, mnhole 3 → 4
1 dip
2. Easement at end of Laurel, 63 foot pipe, manhole 11 → 12
Roots at almost every joint
1 crack
1 offset joint
1 area of grease
3. Easement at end of Koa, 3 foot pipe, manhole 13 → 13A
Pipe deflected, camera will not fit into line – inspection not completed
4. Easement at end of Koa, 5 foot pipe, manhole 13 → 12
Root blockage so severe that camera cannot enter, inspection not completed.
5. Ironwood, from Paula, 306 foot pipe, manhole 57 → 57C
26 offset joints
1 area of mortar debris
6. Avalon from Laurel to Ironwood, 338 foot pipe, manhole 76 → 77
Roots in a few joints
4 radial cracks
1 offset joint
1 broken joint
7. Greenwood from Elena, 39 foot pipe, manhole 54 → 53
2 offsets, 1 so major that camera could not get past it (at 53 feet)
8. Greenwood from Elena, 291 foot pipe, manhole 54 → 55
Roots in a couple of areas
1 offset joint
4 cracks
1 area of debris
1 hole in top of pipe
1 chipped area
9. Greenwood between Elena and Paula, 291 foot pipe, manhole 55 → 56
6 offset joints
1 crack
1 dip
10. Greenwood to Paula, 293 foot pipe, manhole 56 → 61
Roots in one area
1 offset joint
3 cracks
1 hole in bottom of "tap"
3 dips
11. Greenwood from Paula, 331 foot pipe, manhole 61 → 62
3 offset joints
2 chipped joints
2 cracks
3 areas of debris
2 dip
12. Greenwood between Paula and Bonita, 327 foot pipe, manhole 62 → 63

3 offset joints, one major
1 broken joint
4 cracks
Hole at bottom portion of "tap"

13. Greenwood to Avalon, 325 foot pipe, manhole 63 → 82

1 area of roots
5 offset joints
2 cracks
2 dips
1 area of possible debris

14. Ironwood, north of Elena, to Greenwood, 427 foot pipe, manhole 51 → 53

Roots at 4 joints
1 offset joint
2 cracks

15. San Joaquin from Elm to Cedar, 279 foot pipe, manhole 50 → 52

6 offset joints
1 dip

16. San Jacinto from Cedar to Alder, 279 foot pipe, manhole 45 → 47

3 cracks
1 dip

17. Sicily to Tide, 90 foot pipe, manhole 35 → 36

Roots in 5 areas, 1 severe
1 offset joint
1 crack
1 area of debris – stopped inspection at 90 feet.

18. Yerba Buena from Tide, 38 foot pipe, manhole 24 → 25

4 offset joints, 2 severe, and one so bad it stopped the inspection – camera can't get past

19. Yerba Buena just east of Maon, 229 foot pipe, manhole 25 → 24

3 offset joints
1 crack

20. Island from Sandalwood, 50 foot pipe, manhole 33 → 32

Roots at 1 joint
Metal "rod" in line, stopped inspection as camera could not get past

21. Coral between Island and Hatteras, 110 foot pipe, manhole 34 – 34A

Roots in almost every joint
1 offset joint
1 area of debris
1 dip

22. Sandalwood between Bali and Andros, 102 foot pipe, manhole 49 → 49A

Roots at 3 joints
Sand in two areas; so bad in second area that camera could not get through – ended run.

MB Logs - Set 4

The following 20 inspection logs are contained in a single document, dated July 24 - 25, 2007, done by Video Inspection Specialists, Inc.

We did not review the tape covered by this set of logs, so there are no corresponding independent log sets.

Areas of Morro Bay Included:

This set of logs includes inspections of pipes in the downtown area lower Morro Heights, and a section of Ironwood Avenue adjacent to Highway 41.

Summary of Findings for This Set of Logs

These 20 inspections covered a total of 4,245 feet of pipe. One page of one log, covering 104 feet, was missing from the materials we received, and so we saw logs for, and will address problems found in the remaining 4,141 feet. – approximately .78 mile.

Problems identified in this set of logs include:

- **Roots in almost every joint in a total of about 2,520 feet of pipe, or about .48 mile. Any root infiltration at a joint indicates that there is separation and/or offset and/or cracking, because there must be an opening for roots to enter. If we assume joints at approximately every 8 feet, this would indicate that there are approximately 315 joints with some type of damage that has allowed roots to penetrate.**

For the most part, these logs did not identify the specific joint problems that allowed root infiltration. Other problems specifically identified include:

- **18 offsets**
- **7 cracks**
- **4 areas with grease**
- **2 areas with debris**
- **3 dips**

Summaries by Log

1. South on Napa from Harbor; 185 foot pipe, manhole 3 → 3A
Roots at almost every joint
2. North on Napa from Harbor to Dunes – 83 foot pipe, manhole 3 → 2
Roots almost every joint,
3. South on Napa from Harbor to Dunes, 263 foot pipe, manhole 2 → 3
Not bad up to 212 feet; then roots in every joint.
4. North on Shasta from Harbor, 76 foot pipe, manhole 1 → 1A
Roots in almost every joint
5. East on Harbor from Shasta, 256 foot pipe, manhole 1 → 1B
Roots in most joints from 43 feet to 213 feet
3 offsets
1 crack
6. East on Morro Bay Blvd from Shasta, 201 foot pipe, manhole 47A → 47B
Roots in most joints after 87 feet
1 crack
7. West on Morro Bay Blvd. from Shasta to Napa, 146 foot pipe, manhole 47A → 47
Roots in most joints
1 crack
1 area of grease blockage
8. East on Morro Bay Blvd. form Monterey, 176 foot pipe, manhole 53 → 53B
Roots in almost every joint
2 offsets, one of them major
9. West on Morro Bay Blvd. Monterey to Main, 309 foot pipe, manhole 53 → 54
Roots most joints in about 256 feet of the pipe

- 1 offset – in Y
- 1 area of grease
- 1 area of debris
- 10. North on Main from Harbor, 251 foot pipe, manhole 6A → 6
 - Roots in almost all joints
 - 3 offsets
 - 2 areas with grease
 - 1 possible hole or service in top of pipe
- 11. Parking lot of Bay Auto Machine, 185 foot pipe, manhole 22 → 22A
 - Roots at two joints, 2 Y's
 - 1 offset joint in Y
- 12. Parking lot of Bay Auto Machine, 185 foot pipe, manhole 22 → 23
 - 1 dip
 - 1 radial crack at joint
 - 1 joint with infiltration
- 13. West on Morro Bay Blvc. From Bernardo, 280 foot pipe, manhole 27 → 28
 - Roots at most joints in about 132 feet of the pipe
- 14. West on Morro Bay Blvd. from Bernardo, 314 foot pipe, manhole 28 → 33
 - Roots in most joints
 - 3 longitudinal cracks
 - 4 offsets
 - 1 joint with infiltration deposits
- 15. North on Piney from Morro Bay Blvd., 8 foot pipe, manhole 33 → 32
 - Pipe so "tuberculated" that camera can't get through – only made it 8 feet in
- 16. South on Piney from Harbor, 151 foot pipe, manhole 32 → 33
 - Log incomplete* – page missing from copy we received. Only have notes up to 47 feet.
 - Up to 47 feet, roots at 2 joints, and 1 dip
- 17. West on Ridgeway from Bernardo to Piney, 352 foot pipe, manhole 20 → 21
 - Roots at most joints from 127 to 331 feet
 - 1 offset
- 18. North on Ironwood from Hwy 41, 200 foot pipe, manhole 7 → 7A
 - Roots at most joints from 127 feet to 159 feet.
 - Debris or root blockage at 200 feet
- 19. East on Hwy 41 from Ironwood, 315 foot pipe, manhole 6 → manhole 7
 - Roots at every joint 47 – 74 feet, 111 – 135 feet, 167 – 184 feet, several others
 - 1 dip
 - 3 offsets
- 20. West along Hwy 41, from Ironwood, 309 foot pipe, manhole 7 → 8
 - Roots in most joints, from 43 feet, on. Major blockage at 309 feet

Appendix B – Comparison of Independent and MB Logs

This is a comparison of our independently document logs of one of the videotaped inspections with the logs done by the contractor.

COMPARISON A

Independent

1. Main south of Island,

- 2 offset joints
- 1 crack
- 1 major break and dislocation with radial cracking
- 1 area of heavy grease, extends about 15 feet
- 2 areas of debris, one of which stopped the camera

MB

9. Main, just south of Island, 98 foot pipe, manhole 73 → 1

- 1 offset joint
- 1 possibly tuberculated area
- 1 hole
- 1 break, with offset major enough to stop camera from passing

COMPARISON B

Independent

2. Main at Jamaica, going south, manholes 69 → 73

- Roots at most joints from 23 feet to 163 feet
- 9 offset joints
- 2 cracks
- 1 offset joint with separation and radial crack
- 5 joint dislocations, 1 major
- 6 joint separations
- 1 belly

MB

10. Main, from Jamaica, heading south, 225 foot pipe, manhole 69 → 73

- Roots at most joints 9 feet to 174 feet
- 2 cracks

COMPARISON C

Independent

3. Alva Paul Creek to Sequoia, manhole 1 → 3

- 61 offset joints, some severe
- 6 separated joints
- 5 joints with separation and offset
- 9 Cracks, most are severe
- 4 bellies
- 1 manhole with pan missing

MB

11. Main between Alva Paul Creek and Sequoia, 725 foot pipe, manhole 1 → manhole 3 .
2 offset joints, 1 major
9 cracks
2 dips

COMPARISON D

Independent

4. Easement between Preston land and Little Morro Creek
Roots in several joints
18 offset joints
2 joints with offset and separation
1 separation
2 poorly connected lateral lines
1 area with multiple cracks, piece of line appears ready to come loose

MB

12. Easement between Preston and Little Morro Creek Road, 80 foot pipe, manhole 30 → 30A
Corresponds to Independent Logs, Set 2, item 4.
Roots at 3 joints
8 offset joints
1 crack

COMPARISON E

Independent

5. Koa, Conejo to San Juan, manhole 32 → 33 Corresponds to MB Logs, Set 3, item 13

10 offsets, 2 major, 4 minor
1 minor separation
2 joints with offset and separation

MB

13. South on Koa from Conejo to San Juan, 88 foot pipe, manhole 32 →
Roots at one joint

COMPARISON F

Independent

6. Laurel south from Avalon, manhole 76 – 76B
Roots in joints in about half of the pipe; two large root balls
11 offsets, 3 major, 2 minor
3 separations
1 area of cracking
1 dislocation
2 lateral connections too close together (weakens pipe), 1 dislocated, 1 plugged
1 large piece concrete debris

MB

14. South on Laurel from Avalon, 60 foot pipe, manhole 76 → 76B
Roots at 5 joints
3 offset joints

COMPARISON G

Independent

7. Kern, manhole 9 → 7

Roots in most joints
23 offsets, 3 major, 1 minor
2 separations
5 areas with cracking, several severe, multiple cracks, 2 with piece of pipe loose
2 bad lateral connections
2 dislocated joint

MB

15. North on Kern Avenue, 127 foot pipe, manhole 9 → 7

Roots at almost every joint
6 offset joints
4 cracks
1 area with multiple cracks, described as "crushed"

COMPARISON H

Independent

8. Kern, manhole 7 → 9, going south

Roots at most joints, from 58 feet on, severe in several areas; 1 area where 80% of pipe is filled
24 offsets, 6 minor
33 separations, 2 major
1 joints with offset and separation
3 areas with cracking, one with piece of pipe loose, looks as if it could come out
2 bad lateral connections
1 manhole with missing pan

MB

16. South on Kern, 272 foot pipe, manhole 7 → 9

Roots at almost every joint from 58 feet, on
1 crack
1 dip

Wastewater Collection System Video Inspections

Issues and Concerns

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October, 2007

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Introduction

In recent discussions at the Morro Bay Public Works Advisory Board, members were assured that an inspection program is planned to help ensure better maintenance of the wastewater collection system in the future. While we consider this excellent news, we have some concerns. In conducting our own reviews of some of the videotaped inspections, we found that many defects had not been logged by the contractor, or that had been logged in such a way that the severity of the problem was not evident. In addition, we observed evidence that, even when defects are logged, they are not always fixed in a timely manner.

Our collection system is in a serious state of disrepair, and we need to get maximum value from the inspections that have been done, and those that will be done in the future. We have described here some of the problems we have noted in the inspection process, and recommended actions to resolve those problems.

Failure to Accurately and Completely Log Defects

The logs produced in recent video inspections of the wastewater collection system do not include many of the defects we observed when we did our own independent review of the inspection tapes. Further, in some cases, defects are logged, but descriptions do not accurately reflect their severity.

It seems unlikely that the defects we saw could be missed by a reasonably knowledgeable person. Even the images in this document (created using the decidedly low-tech method of photographing scenes from the videotape on a television screen) clearly show defects in the lines. Those defects are even more obvious when the tape is viewed. Yet, many significant defects are, along with most smaller ones, do not appear in the logs done for the City.

Watching the video tapes takes time, and we believe that City staff are likely to rely on the logs when they want to know the condition of lines in the system. They cannot fix or monitor problems they are unaware of. Significant defects, incorrectly logged, or not logged at all, are likely to go un-repaired. Potential problem areas, where smaller defects exist, but are not reported, cannot be monitored. Following are examples of some of the logging errors we observed.

Offsets Between Manholes 32 and 33

The image in Figure 1 is from an inspection tape made in January, 2007. This line is on Koa, a hillside street in North Morro Bay. In this image, two significant offsets are visible, creating a sort of "waterfall" effect. The potential for exfiltration to occur at these joints is high.



Figure 1

However, the log (Figure 2) mentions only the lateral connection near these two offsets.

APPROXIMATELY 90 FT. DOWNSTREAM FROM MANHOLE #32

<u>FOOTAGE</u>	<u>FRAME</u>	<u>OBSERVATION</u>
5	51:15	START RUN AT MANHOLE #32
48	53:25	ROOTS AT JOINT - LIGHT
85	54:50	LEFT Y
88	55:58	END RUN AT DROP MANHOLE #32A - APPROXIMATELY 90 FT. TO CENTER OF THE MANHOLE

CONTINUED ON SHEET #2

Figure 2

Crack and Offset Between Manholes 7 and 9

The image in Figure 3 is also from an inspection tape made in January, 2007. This line is on Kern Avenue. One can readily see a crack. As the camera panned the area, it was clear that the cracking was extensive enough that a piece of the pipe could potentially come loose. Looking toward the lower right of the image, it is also obvious that there is a significant offset at this joint.

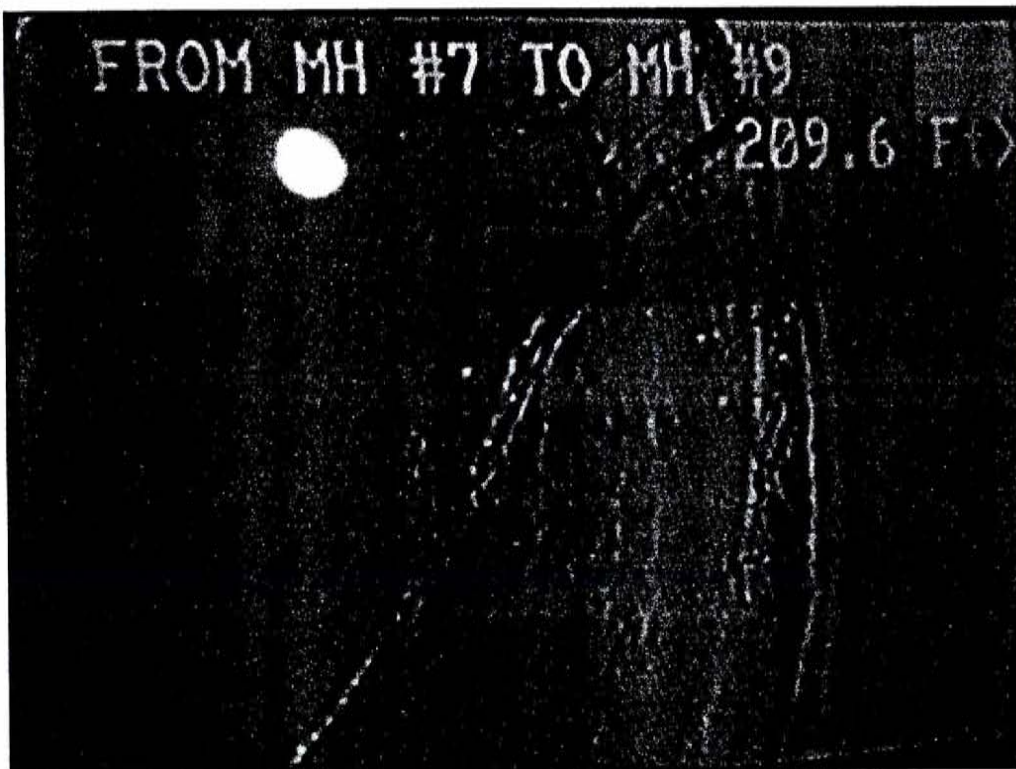


Figure 3

However, looking at the log (Figure 4) we see that the entries note only that at 210 feet, there is a "radial crack at joint - light", and "roots at joint - light". No mention is made of the offset. This is another area with a high potential for exfiltration of sewage into the soil.

205	1:32:15	END RUN AT MANHOLE #8
210	1:32:55	RADIAL CRACK AT THE JOINT - LIGHT
210	1:33:00	ROOTS AT JOINT - LIGHT
217	1:33:30	ROOTS AT JOINT - LIGHT
220	1:33:35	ROOTS AT JOINT - LIGHT
223	1:34:00	START ROOTS AT EVERY JOINT
263	1:35:35	START DIP
264	1:36:00	RIGHT TAP - ROOTS IN TAP

CONTINUED ON SHEET #: 33

Figure 4

Bad Lateral Joint Between Manholes 7 and 9

In the following image, also from a January, 2007 inspection, we see a poorly installed lateral connection with offset, and with significant cracking visible in the left half of the image.



Figure 5

However, in the log (see figure 4, previous page), the notation for 264 feet, says only, "right tap – roots in tap". The next and last entry in this log is for the end of the run.

We found that our logs consistently noted far more defects than those of the contractors. For example, here is a comparison of our logs, versus those of the contractors, for one section of line from a video inspection done in January, 2007.

South on Laurel from Avalon, 60 foot pipe, manhole 76 → 76B	
Our log	Morro Bay Log
Roots in joints in about half of the pipe; two large root balls 11 offsets, 3 major, 2 minor 3 separations 1 area of cracking 1 dislocation lateral connections too close together (weakens pipe), 1 dislocated, 1 plugged 1 large piece concrete debris	Roots at 5 joints 3 offset joints

We believe that our log gives a far better picture of the condition of the line. We consider this section to be in poor condition, and in need of repair. The Morro Bay log gives the impression that this section of line is in, at worst, fair condition. Incomplete logging gives a false impression of the condition of the line, and can delay repairs.

Deferred Maintenance - Failure to Repair Logged Defects

We are also concerned about failure to correct those defects that are logged. We will provide here a particularly disturbing example of a major problem that was left un-repaired for a period of years. If this was not considered important enough to fix, it seems reasonable to assume that other defects, perhaps less severe, but still significant, were also ignored. Clearly, it does little good to inspect the system if the inspections don't result in timely repairs.

Sunken Sewer Main/Lateral Not Repaired for Seven Years

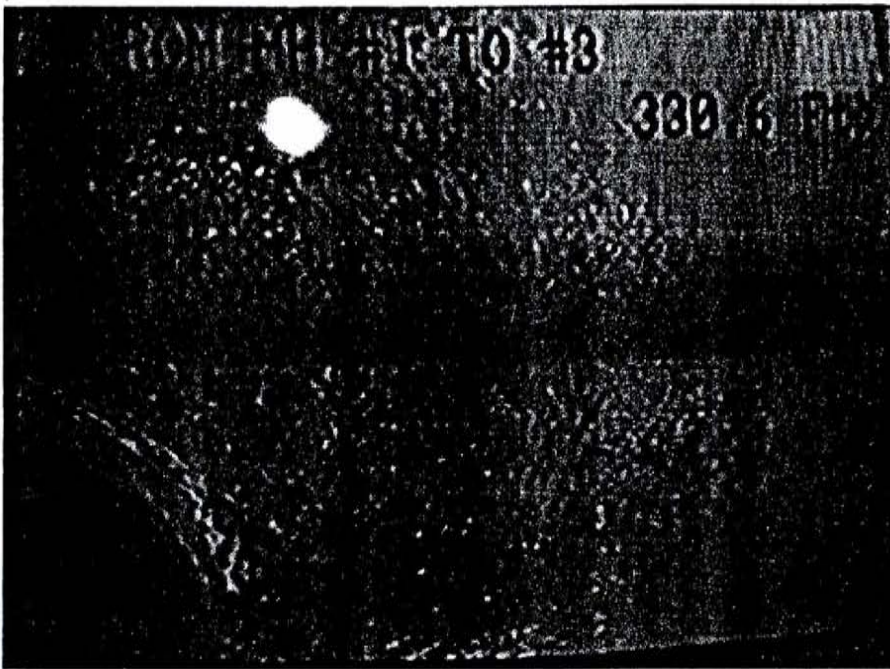


Figure 6

We had the opportunity to review taped inspections, done seven years apart, of a section of the Main Street trunk line that lies between Island and Sequoia. The image in Figure 6, from an inspection done in January, 2007, shows a sewer main that had sunk to the point that it was clearly depositing sewage under, rather than into the Main Street trunk line. Only the top 1/3 of the main is still visible. A faint outline of the original position of the connection can be seen above the opening. When this area is viewed in color, it is obvious that the upper 2/3 of the original opening, made in the trunk for this connection, has filled in with soil.

We were able to find the approximate location of this main, near manhole 2, in front of a condominium complex in the 3000 block of Main Street. It appears to us that the main (or "private lateral", as a Morro Bay City employee called it) serves at least 23 condominium units. If the sewage for even one home were dumped into the soil every day for seven years, the resulting pollution would be serious; but here, we are talking about 23.

When we later viewed a 2000 inspection of the same section of line, we saw the same connection. It did not look much better in 2000 than it did in 2007, meaning that the sewage carried by the main/lateral had been dumped under the trunk line for at least seven years. This is even more disturbing, given that the written log of the 2000 tape had noted this defect

Figures 7 and 8, below, are from the log of the 2000 inspection.

☆

2 → 3 Counter reset
320 offset joint
325 toplateral - lateral broken - dirt evident
↳ tape says defective connection

Figure 7

In Figure 7 is the notation that, at 325 feet, there was a broken lateral with dirt evident, referred to on the tape as a "defective connection". There is only main/lateral in this area of the line, and there is no doubt that the defective connection seen in Figure 6 is the one mentioned above, in Figure 7.

There does appear to have been some confusion, as the internal labeling of the videotape was incorrect. In fact, the section in Figure 7 should have been labeled as 1 → 2. The person writing the log clearly corrected the label for the first item in Figure 8, but did not correct the labeling of the item in Figure 7.

?

2 → 3 Counter reset
166 - cracked pipe - dirt visible

3 → 9 Counter reset
66 - offset joint

Figure 8

Still, this minor confusion should not be considered a good reason to ignore a serious defect, and most certainly not for seven years. We did not find it difficult to determine the correct labeling for the items, and assume it would be even easier for the inspector, or for a City employee familiar with the collection system. We believe that the inspector marked the item with a star because the defect was very serious, and required prompt repair. Unfortunately, action to resolve the problem was anything but prompt.

While we did not find any other ignored defects of this magnitude, the section of line for which we viewed both 2000 and 2007 inspections is very short, and thus the opportunity to identify other failures to repair major defects was extremely limited. However, we did note that, in Figure 7, an offset joint was noted to be present 4 feet from the sunken main/lateral connection. In the 2007 inspection tape, an offset joint is also visible at that exact location. This is not surprising. If a sunken main was not fixed, one would not expect to see repair of an offset.

Although we have not personally identified evidence to prove our theory, we believe that it is likely that a significant number of other defects from inspections done prior to 2007 have also gone un-repaired for a period of years. It must also be noted that inspections done before 2007 cover a very limited area of the City. There may be other very severe defects that have existed for many years, but that have never been found.

Deferred Maintenance by Other Entities

We believe that Morro Bay, along with all of the other users of our Wastewater Treatment Plant, have followed a policy of deferred maintenance for many years, instead of taking a proactive approach to maintaining collection system infrastructure. We consider this is a serious example of false economy, and believe that the results of the "savings" include ongoing pollution of our groundwater and the environment, ongoing risks to health and safety, and further damage to the system. As sewage leaks out of dilapidated collection lines, it can contribute to sinking and sliding of surrounding soil, and speed the deterioration of the system, which allows for more leakage.

We believe that Cayucos has failed to maintain its collection system in good repair, and are also concerned about facilities at the Morro Bay Golf Course, and in the State Park. Failure of any of these system users to properly maintain its wastewater collection infrastructure can have serious negative impacts on the health and safety of Morro Bay residents, and on our environment.

Conclusions and Recommendations

We should not be lulled into a false sense of security by the fact that video inspections of the collection system are being conducted. Performing the video inspection is only one step in a process. Inspections need to be based on appropriate data, defects need to be logged correctly and completely, and repairs need to be appropriately scheduled.

We recommend that the City develop and publish the following:

- Current and detailed inventory and maps of all collection lines, including age of the lines, problem reports, repair records, and inspection records.
- Clear and detailed standards for identifying and logging defects, including "minor" problems, as they tend to grow into major ones.
- An inspection schedule that extends at least two years into the future, based on priorities established using inspection and repair records, and problem reports.
- A repair schedule that is tied to inspection results and records of prior problems and repairs.
- Lateral inspection and maintenance guidelines for property owners. These should be distributed annually in water bills.

We further recommend that City Officials use their influence to ensure that those with whom we share the WWTP follow these recommendations, as applicable, that infrastructure owned by Cayucos, the State Park, and the Morro Bay Golf course are repaired, and that the condition of that infrastructure is closely monitored in the future.