# **Appendix B**

# **Storm Drain Study**

# STORM DRAIN INSPECTION REPORT FOR:



# VA Northern California Healthcare System Alameda Point, CA

March 8, 2016

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#### A. Purpose of Study

This study was performed for HDR Architecture to review the condition of the existing storm drain pipes at the former Alameda Point Naval Base in Alameda, CA. The following report includes a log of the pipe defects, damage, or other issues, recommendations for repair or replacement, and a professional opinion as to the suitability of the piping for reuse by the VA Alameda Point project.

Coinciding with this study was a field topographic survey to tie down the physical location of found storm drain pipes & structures.

#### B. Methodology

The first order of work for this study was data collection. It is understood that in the fall of 2014 a similar video inspection effort was performed (by others). These videos were transmitted to SANDIS in December 2015 and were reviewed for completeness. There were a few videos that included complete segments of pipe, several videos where the pipe location was unidentifiable, and some videos that were abandoned due to debris or water in the existing pipes. For the pipes whose location was clear and fully video surveyed in 2014, additional video inspection was not attempted as part of this study. For pipes whose location was not identifiable or if there were other issues for completing the work in 2014, effort was made as part of this work (2016) to gather video of the pipes.

Step two was a review with the VA Alameda design team to identify the portions of pipe that were of use or interest to the design team. There were varying degrees of importance for the existing pipe network. The most important pipe networks were near to or connected to the VA's property and identified on the "Phase 1 Site Plan – Proposed Easement Map" (by others) as outfalls 2, 3, 5, 7, 10, & 12 (APPENDIX E). For these outfalls the study would attempt to video the pipe and provide a 30' strip survey along the existing pipe. Of secondary importance were outfalls 8, 9, & 11 because they were thought to be smaller diameter pipes or otherwise not connected to the VA Site. This study would include identifying the location and size of the pipe but not attempt video inspection. The outfalls shown as 1, 13, & 14 were of least importance because they were not near the VA project site and it was unlikely they would be used. For these outfalls, the location and pipe size was to be investigated if possible.

The next step was to coordinate site access with the Navy, the City, and the various survey crews and begin the work. Access to the site was limited to a period from February 1 – February 26 and could be accessed from 7:30 am – 6 PM. Since the storm drain pipes were connected to the bay and at a very low elevation, the video inspection work was timed with the Tides in order to access the storm drain pipes at low tide and reduce the likelihood of water in the pipes. It should be noted that videos cannot be taken if the pipe is submerged.

At the time of the survey work, there were several areas of the site that were planned to be accessed with the support of a Navy Radiological technician. When these areas were ready to be accessed, identified as IR 32 on the site maps, it was determined that additional access would be required since this site had not been mitigated. Due to timing constraints in getting access, the effort to collect data in the IR 32 area was abandoned.

## C. Common Issues Impacting Video Survey

In general, the condition of the structures, pipes, and outfalls found on site was poor due to an apparent lack of maintenance and deterioration with age. There were several common problems that directly impacted the completeness of the video survey. We would recommend that these obstructions be corrected prior to attempting another video surveying effort. The locations where these problems were encountered are shown on the "Storm Drain – Video Inspection Exhibit" in Appendix A. These included the following:

1.) <u>Rims on Catch Basins were rusted shut</u>. Due to age and deterioration, several rims were inoperable and rusted shut to the frame of the inlet. To mitigate this condition, the rims would have to be forcefully removed which would likely break them so if this was attempted the owner should be prepared to replace the rims and/or catch basins if intended for future use. A photo of this condition is shown below.



Structure: 7-21

2.) Inlets or Manholes were buried or otherwise covered. In locations where inlets were expected to be, debris piles, trench plates, dirt, or overgrowth were present so the storm drain pipe could not be inspected. In cases where debris or other material can be removed or relocated it is possible that the inlets could be located and inspected but it is unlikely they would be found if buried. Photos of this condition are shown below.



Structure 2-10 shown. Structure 2-06 not located.

3.) <u>High Water Level encountered in pipes</u>. As mentioned previously, the work was timed with the low tide to best mitigate this issue. However, in several locations high water level prevented the completion of a portion or entirety of a storm drain pipe. It is possible that the pipes are clogged downstream and water is not being released which is creating this condition. To fix this issue, we recommend the water be pumped out and the pipe be cleaned or repaired as needed. A photo of this condition is shown below.



Subdynamic Survey (2016) - Structure 7-20 to 7-21

4.) <u>Silt, Sediment, or Debris clogging pipe</u>. This was the most common problem and prevented completion of the video inspection in the majority of the pipe on this site. This issue can be mitigated by hydrojetting or vacuum cleaning the pipes in order to re-attempt the video inspection. In some cases portions of the pipe may need to be physically removed in order to complete the video inspection. Photos of this condition are shown below and seen in the videos that were performed.



Subdynamic Survey (2016) - Structure 8-26 to 8-27



Subdynamic Survey (2016) - Structure "Unknown" to 10-29A

# D. Results of Video Inspection Survey

The results of the video inspection survey are included in the tables on the following pages. Inspection videos and reports from the 2016 Subdynamic video survey are included in Appendix B. Video inspection reports performed by others in 2014 are included in Appendix C for reference.



#### **Pipe Network: OUTFALL 2**

STRU	CTURE #*					COUN	IT (FT)				VIDEO SURV	EY		VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
12	9	СМР	10	178	0				Structure 12 was unable to be video surveyed due to water			х	2016	N/A
8	9	N/A	10	133	0				Structure 8 was unable to be video surveyed due to water			х	2016	N/A
9	10	CMP	12	344	0				Structure 9 was full of water			Х	2016	N/A
10	6	СМР	12	362	0				Structure 10 was unable to be opened due to rust and was full of water			х	2016	N/A
6	OUTFALL 2	СМР	12	369	0				Structure 6 could not be found			х	2016	N/A

\* = STRUCTURE # (AS REFERENCED ON "STORM DRAIN - VIDEO INSPECTION EXHIBIT" IN APPENDIX A)

(#) = STRUCTURE LABEL AS REFERENCED ON THE VIDEO SURVEY DVD & INSPECTION REPORT (PER THE YEAR OF THE VIDEO SURVEY)

**BOLD STRUCTURE #** = STARTING STRUCTURE OF VIDEO SURVEY

CMP = CORRUGATED METAL PIPE

CP=CONCRETE PIPE (NON-REINFORCED)

RCP = REINFOCED CONCRETE PIPE

DIP = Ductile Iron Pipe

PE = POLYETHYLENE

PVC = Polymerized Vinyl Chloride



#### Pipe Network: OUTFALL 3

STRU	CTURE #*			TOTAL DIDE		COUN	T (FT)			VIDEO SURVEY			VIDEO	
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
15	14	PVC	21	348	157	0.0	157.0		Survey abandoned due to excessive amount of silt, camera could not pass. 25% full of silt.		Х		2016	4
						108.6	219.4	Settled sediment and gravel	Some water in the pipe throughout the entire pipe					
						325.8	325.8		Tap from structure					
14 (16)	OUTFALL 3 (16OF)	CMP	30	681	403.2	361.3	403.2	Water level gets higher			Х		2014	3
						401.5	401.5	Infiltration dripper						
						403.2	403.2	Survey abandoned	Survey abandoned due to debris					
						0.0	5.6	Water in pipe						
16 (18)	14 (16)	PE	12	431.1	431.1	3.0	6.0	Debris and settled gravel and deposits		х			2014	3
						416.7	423.2	Debris and settled gravel and deposits						
						0.0	11.6	Water	Tee connection to line between 16 and 16OF					
						0.0	11.6	Settled gravel and sediment						
						11.6	15.6	Surface corrosion on pipe						
13 (14)	13A (14A)	CMP/RCP	12	78	78	20.0	20.0	Surface corrosion on pipe		х			2014	2
						31.8	32.4	Surface corrosion on pipe						
						61.3	61.3	Pipe material change - CMP to RCP						
						78.0	78.0	Tee connection						

\* = STRUCTURE # (AS REFERENCED ON "STORM DRAIN - VIDEO INSPECTION EXHIBIT" IN APPENDIX A)

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PVC = Polymerized Vinyl Chloride

Date:8-Mar-16Project #:615110Project:VA ALAMEDA - ALAMEDA POINT, CA



#### **Pipe Network: OUTFALL 5**

STRU	CTURE #*					COUNT (FT)					VIDEO SURVE	Y	YEAR OF	VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
14A (14)	17	СМР	12	376	0	0	0		Excessive mud in pipe, unable to record			х	2016	1
						16.5	16.5	Infiltration dripper						
17	OUTFALL 5	СМР	12	581	19.8	19.8	19.8		Pipe has compacted debris throughout, cannot get passed. 25-50% full of water.		Х		2016	1

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DIP = Ductile Iron Pipe

PE = POLYETHYLENE

PVC = Polymerized Vinyl Chloride

UNK = UNKNOWN

CIVIL ENGINEERS SURVEYORS PLANNERS



#### Pipe Network: OUTFALL 7

STRU	CTURE #*					COUN	IT (FT)				VIDEO SURVI	Y		VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
19	20	СР	12	95.6	95.6	0	95.6		40% Water level 8.8 feet	Х			2016	1
20	21	СР	12	207	0	0	0		Survey abandoned, excessive debris in line			х	2016	1
23	24	СР	8	59	19.4	0	19.4		Pipe filled with water and debris, camera under water entire time		Х		2016	1
24	21	СР	12	218	0				Structure 24 was unable to be video surveyed due to water				2016	N/A
21	OUTFALL 7	СР	21	305	0				Could not open Structure 21				2016	N/A

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#### Pipe Network: OUTFALL 8

STRU	CTURE #*		DIAMETER	TOTAL PIPE	PIPE LENGTH	PIPE LENGTH COUNT (FT)					VIDEO SUR\	YEAR OF	VIDEO	
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
26	27	СР	14	194	7.1	0	7.1		Survey abandoned due to excessive debris in line, dirt and debris fills approximately 50% of line		х		2016	2
27	OUTFALL 8	DIP	14	127	3.8	0	3.8		Survey abandoned due to excessive silt in line, silt fills 50% of line and camera cannot pass		х		2016	2

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PVC = Polymerized Vinyl Chloride



#### **Pipe Network: OUTFALL 10**

STRU	CTURE #*					COUN	NT (FT)				VIDEO SURVE	Y		VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	(IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
						760.0	1072.6	Water level starts to rise	MH10 filled with water					
28 (9)	29 (10)	RCP	30	1072.6	1072.6	932.9	1072.6	Sag in line		Х			2014	1
						1072.6	1072.6	Intruding sealing grout						
29D (29A)	29E (OUTFALL 10)	СР	12	23.0	10.0	0.0	10.0		Survey abandoned due to excessive amount of debris on bottom of pipe, camera could not pass, 20% water level		x		2016	3
						3.3	4.3	Water in pipe-possible sag						
						26.7	26.7	Infiltration dripper						
29 (10)	OUTFALL 10	PVC	30	468	59 4	51.3	51.3	Infiltration dripper			x		2014	1
	(OUTFALL)	1.10	50	100	5511	59.4	59.4	Infiltration dripper			X		2011	-
						59.4	59.4		Survey abandoned due to debris					
						89.4	89.4	Sag in line						
34 (20)	32 (19)	Steel Pipe	12	310	310.0	89.3	310.0		High water level at end of survey	Х			2014	3
33	32	СМР	36	586	0.0				Water level to high to survey			Х	2016	N/A
32 (19)	31 (12)	СМР	21	285	4.4	4.4	4.4		Survey abandoned due to high water level		х		2014	2
						4.2	4.2	Intruding sealing grout	MH 12 has some water					
						55.5	55.5	Infiltration dripper	Water in entire pipe					
31 (12)	30 (11)	RCP	30	466	409 3	208.3	409.3	Water level rises			x		2014	2
51 (12)	50 (11)	i i i i i i i i i i i i i i i i i i i	50	400	403.5	301.3	301.3	Infiltration weeper			X		2014	2
						409.3	409.3		Survey abandoned due to high water level					
						16.2	16.2	Infiltration dripper	MH 11 Has some water					
						276.6	276.6	Infiltration dripper						
30 (11)	29 (10)	RCP	30	572	5/13 2	276.6		Sag in line			x		2014	2
50 (11)	23 (10)	NCF	50	572	575.2	429.2	543.2	Water level rises			^		2014	
			30 572	543.2	543.2	543.2		Survey abandoned due to high water level	ue to high					

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#### Pipe Network: OUTFALL 12

STRU	CTURE #*					COUN	T (FT)				VIDEO SURV	ΈY		VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	DIAMETER (IN)	LENGTH (FT)	INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	VIDEO SURVEY	SURVEY DVD #
						3.8	3.8	Infiltration dripper						
						4.7	4.7	Water level sag						
						9.1	9.1	Camera underwater						
43 (25)	42 (24)	СМР	8	106	88.6	29.3	29.3	Deposits attached encrustation		x			2014	4
						38.5	38.5	Camera underwater						
						88.6	88.6	Deposits attached encrustation						
						88.6	88.6	End of survey						
						5.2	5.2	Deposits attached encrustation						
						8.8	8.8	infiltration stain						
						20.7	20.7	infiltration stain						
	11 (21)	2.02	10	10	10 7	23.3	23.3	infiltration stain					2244	
42 (24)	41 (21)	RCP	12	46	43.7	26.5	26.5	cracks		Х			2014	3
						29.5	29.5	infiltration stain						
						43.1	43.1	joint offset large						
						43.7	43.7	infiltration stain						
						43.7	43.7	End of survey						
						1.8	1.8	Infiltration stain, longitudinal fracture						
						2.0	2.0	Infiltration stain					1	ľ
						5.0	5.0	Infiltration stain						
						14.5	14.5	Infiltration stain						
41 (21)	40 (22)	RCP	15	54	50.5	24.0	24.0	Infiltration stain		х			2014	3
						26.9	26.9	Infiltration stain						
						48.9	48.9	Infiltration dripper						
						50.5	50.5	End of survey						
						0.1	0.1	Infiltration stain						
40 (22)	39 (23)	RCP	36	59	55.4	18.7	18.7	Infiltration dripper		х			2014	3
						35.9	35.9	Infiltration dripper						
39 (23)	38 (13)	RCP	36	67	63.1	63.1	63.1	Infiltration stain		×			2014	3
	30 (13)				00.1	63.1	63.1	End of survey		~			2017	
49 (31)	48 (30)	RCP	12	49	47.0	5.5	5.5	Infiltration dripper, deposits attached encrustation		x			2014	4
						47.0	47.0	End of survey						
						-				-				-



#### Pipe Network: OUTFALL 12

STRU	CTURE #*					COUN	IT (FT)				VIDEO SURV	EY		VIDEO
UPSTREAM	DOWNSTREAM	MATERIAL	DIAMETER (IN)	TOTAL PIPE LENGTH (FT)	PIPE LENGTH INSPECTED (FT)	START	END	DEFECT	NOTES	COMPLETE	STARTED AND ABANDONED	ATTEMPTED - BUT UNABLE TO START	YEAR OF VIDEO SURVEY	SURVEY DVD #
						0.2	0.2	Deposits of settled gravel						
						1.7	1.7	Infiltration dripper						
48 (30)	47 (29)	RCP	12	51	48 1	36.0	36.0	Infiltration stain		x			2014	4
				01	.0.2	41.9	41.9	Deposits attached encrustation		ĥ				
						48.1	48.1	End of survey						
						1.5	1.5	Deposits attached encrustation	MH29 has water in it					
						4.8	4.8	Alignment left						
						13.3	13.3	Water level decreases						
						26.7	26.7	Infiltration stain						
47 (20)	46 (28)	DCD	10	50	F1 2	29.8	29.8	Infiltration weeper					2014	4
47 (29)	46 (28)	KCP	18	53	51.2	32.7	32.7	Infiltration stain		x			2014	4
						36.4	36.4	Infiltration stain						
						41.6	41.6	Infiltration dripper						
						51.2	51.2	Deposits attached encrustation						
						51.2	51.2	End of survey						
					_	11.9	11.9	Infiltration stain						
					21.4	21.4	Infiltration dripper							
						36.4	36.4	Infiltration dripper						
						39.2	39.2	Infiltration dripper						
						45.2	45.2	Infiltration dripper						
						54.2	54.2	Infiltration runner						
						60.2	60.2	Deposits of settled gravel						
46 (28)	45 (27)	RCP	18	99	83.4	66.4	66.4	Infiltration dripper			Х		2014	4
						68.9	68.9	Infiltration dripper						
						72.1	72.1	Infiltration dripper						
						81.3	81.3	Infiltration runner						
						92.4	02 /	Infiltration stain, infiltration						
						65.4	03.4	dripper						
						83.4	83.4		Survey abandoned due to debris					
						1.0	1.0	Infiltration dripper						
						17.5	17.5	Infiltration stain						
						07.6	07.6	Joint offset medium, infiltration						
						97.0	97.0	dripper						
	(27) <b>44 (26)</b> RCP 24 1			99.3	99.3	Broken void visible								
45 (27)		198.3	198.3	128.5	128.5	Infiltration dripper		Х			2014	4		
						177.0	177.0	Infiltration dripper						
						192.2	192.2	Infiltration dripper						
						195.0	195.0	Infiltration dripper						
						198.3	198.3	Infiltration stain						
				198.3	198.3	End of survey								

# E. Outfall Condition

#### Outfall 2

Size and Material:12" Corrugated Metal PipeCondition:Bottom half of pipe found eroded and rusted. Rocks blocking<br/>outfall pipe upstream.Suitability for Reuse:Outfall is not suitable for reuse.



OUTFALL 2

12" CMP

![](_page_17_Picture_6.jpeg)

OUTFALL 2

12" CMP

Size and Material:	30" Corrugated Metal Pipe (metal has corroded away)
Condition:	Metal pipe has corroded away near outfall and only the concrete encasement remains.
Suitability for Reuse:	It is possible to connect to this outfall as it is still functional. The original pipe having eroded away would suggest reusing this structure would be a temporary condition, requiring rebuilding in the future.

![](_page_18_Picture_2.jpeg)

OUTFALL 3

30" CMP

![](_page_18_Picture_5.jpeg)

OUTFALL 3

30" CMP

Size and Material: Condition:	12" Corrugated Metal Pipe Metal has been corroded and rusted at outfall end. Pipe appears to be structurally intact.
Suitability for Reuse:	The outfall is missing a flap-gate, but may be a candidate for reuse in the short term. Recommend a long-term replacement option be investigated.

![](_page_19_Picture_2.jpeg)

OUTFALL 5

12" CMP

![](_page_19_Picture_5.jpeg)

OUTFALL 5

12" CMP

Size and Material: Condition:	21" Non-reinforced Concrete Pipe The outfall contains debris and needs to be cleaned. There are several rocks that block the discharge point. There is no flap- gate present.
Suitability for Reuse:	The headwall looks intact, therefore if the pipe is cleaned and inspected it is a possible candidate for reuse. Recommend the outlet point be cleared of obstructing rocks.

![](_page_20_Picture_2.jpeg)

OUTFALL 7

21" CP

Size and Material: Condition:	14" Ductile Iron Pipe Outside of pipe is corroded and rusted upstream from the outfall. Pipe looks to be replaced (less corroded) near the headwall.
Suitability for Reuse:	Pipe has a concrete headwall with metal grate at outfall end as seen in the photos below. Outfall appears to be in sufficient shape to reuse. Corrosion of upstream pipe may limit useful pipe life.

![](_page_21_Picture_2.jpeg)

OUTFALL 8

14" DIP

![](_page_21_Picture_5.jpeg)

OUTFALL 8

14" DIP

![](_page_22_Picture_0.jpeg)

OUTFALL 8

14" DIP

![](_page_22_Picture_3.jpeg)

OUTFALL 8

14" DIP

Size and Material:	12" Reinforced Concrete Pipe
Condition:	Pipe ends short of rip-rap. Some pipe segments have fallen apart at the outlet, but the pipe itself appears to be structurally sound
Suitability for Reuse:	Recommend extending pipe to rip-rap to consider reuse.

![](_page_23_Picture_2.jpeg)

OUTFALL 9

12" CP

![](_page_23_Picture_5.jpeg)

OUTFALL 9

12" CP

Size and Material: Condition: 30" PVC PVC outfall is in good shape with rubber tideflex valve at end. There is a large rock that is on valve that would limit the ability to open, but otherwise appears functional. Suitable.

Suitability for Reuse:

![](_page_24_Picture_4.jpeg)

OUTFALL 10

30" PVC

![](_page_24_Picture_7.jpeg)

OUTFALL 10

30" PVC

Size and Material: Condition: 36" Reinforced Concrete Pipe Concrete headwall with no grate was found with rusted pipe end. Outfall appears to be structurally intact. Suitable.

Suitability for Reuse:

![](_page_25_Picture_4.jpeg)

OUTFALL 12

36" RCP

![](_page_25_Picture_7.jpeg)

OUTFALL 12

36" RCP

# F. Conclusions and Recommendations

As indicated in the video inspection survey results and accompanying exhibit, it is clear that the majority of the existing storm drain pipe on site was unable to be adequately inspected due to the various issues accessing the existing storm drain pipes. Of the approximate 13,680 LF of total pipe on the site, only 4,400 LF or 32 % of the pipes were able to be reviewed.

Of the pipes that were able to be inspected, the pipes were generally in fair to poor condition. Some of the common issues found in the inspected pipes were as follows:

- Sediment/Silt Buildup This is a major defect for the functioning of the storm drain pipe system. If the pipes are to be reused, these pipes should be hydro-jetted or vacuum cleaned. As mentioned previously, due to environmental issues, hydrojetting may require collection of blown-out debris. Once pipe has been cleaned, the storm drain pipes should be re-inspected for any other potential structural issues.
- Sag in Pipe This defect reduces the flow capacity of the pipes and can promote future issues including sedimentation build-up and pipe clogging. Where sags are identified, the pipe section should be removed and replaced.
- 3) High Water Level in Pipe Likely caused by downstream clogging. Water should be removed and the pipe re-inspected.
- 4) Surface Corrosion on Pipe Corroded pipes are beyond their useful life and should be replaced. It is impossible to determine the remaining useful life that a corroded but otherwise structurally intact pipe will have. It is possible to prolong the use of the pipe using a pipe slip-lining technique in the short term.
- 5) Disjointed Pipe This is considered a minor defect in the short term. Over time however, there is potential for erosion around the exterior of the pipe which affects its structural stability and could increase the potential for pipe collapse, root intrusion, and clogging. A typical fix for this type of defect would be to excavate, remove, and reset the disjointed pipe segments or the pipe could be slip-lined.
- 6) Infiltration Dripping water (Infiltration dripper) and damp concrete pipe (Infiltration Stain) were both encountered. These defects are considered minor in the short term. A typical fix for this type of defect would be to grout the existing cracks or weak joints to reduce groundwater from infiltrating the existing pipe.

If portions of the existing storm drain pipe are intended to be reused, we recommend that any further investigation be performed after a work plan is developed to include the services of an underground pipe contractor and a hydrojetting and/or vacuum truck contractor to clean the existing pipes, open and replace the existing rusted grates, remove existing debris piles to expose all existing structures, and replace collapsed or broken pipe segments in order to verify the condition of the existing lines that may be reused. After the pipes have been maintained, then a follow up video inspection effort could be performed in order to determine the integrity and suitability for any potential pipe that may be reused.

Since there are several entities involved, a possible scenario would be to have the team onsite and ready to inspect/review the condition of the existing pipes as they are cleaned and to have the contractor replace pipes on an as-needed basis during this maintenance and inspection effort.

Alternatively, since most of the pipes in this system are in disrepair and at the end of their useful design life (60+ years), it may be prohibitively expensive to clean, re-inspect, and spot replace sections of pipe to gain a nominal extension in the existing pipe system's useful life. Therefore, it is our recommendation that the existing pipe network should be replaced to the maximum extent practical and that the existing system be abandoned in place.

It should also be noted that there are several unknowns for the existing storm drain system and this report relied on available Navy storm drain maps to supplement information determined in the field. There are several structures that are included in these maps that were not locatable in the field but are believed to exist or have existed. These uncertainties support our recommendation to install a new system with a known condition (new), useful design life, and location in order to serve the proposed project.

OUTFALL SUMMARY									
OUTFALL #	PIPE	FLAP GATE PRESENT (Y/N)	2016 CONDITION			REUSE			
	DIAMETER (IN)		GOOD	FAIR	POOR	<b>RECOMMENDATION</b> <sup>1</sup>			
2	12	N			Х	No			
3	30	N		Х		Maybe			
5	12	N		Х		Maybe			
7	21	N		Х		Maybe			
8	14	N		Х		Maybe			
9	12	N		х		No <sup>2</sup>			
10	30	Y	Х			Yes			
12	36	N	Х			Yes			
<ol> <li>Outfall's reuse recommendation is based on the general condition of the outfall only. Further inspection/verification would be required to verify the condition of the existing pipe just upstream of the outfall after pipe has been cleaned.</li> <li>YES - Pipe outfall structure is in decent shape with limited apparent structural defects.</li> <li>No - Pipe outfall structure is unusable without substantial improvements below the top of bank at the estuary.</li> <li>Maybe - Pipe outfall structure is intact but may be in questionable condition. Design life may be of issue.</li> <li>Outfall ends short of the estuary and would need substantial improvements to be extended.</li> </ol>									

#### **OUTFALL REUSE SUMMARY:**

# **APPENDIX A**

# **STORM DRAIN – VIDEO INSPECTION EXHIBIT**

![](_page_29_Figure_0.jpeg)

File: X: \P\615110\EXHIBITS\VIDEO INSPECTION\EX-1.dwg Date: Mar 08, 2016 - 2:28 PM

![](_page_29_Picture_11.jpeg)

OUTFALL SUMMARY								
	PIPE	FLAP GATE	2016 CONDITION			REUS		
OUTFALL #	DIAMETER (IN)	PRESENT (Y/N)	GOOD	FAIR	POOR	RECOMMEN		
2	12	N			Х	No		
3	30	N		Х		Mayb		
5	12	Ν		Х		Mayb		
7	21	N		Х		Mayb		
8	14	Ν		Х		Mayb		
9	12	Ν		х		No <sup>2</sup>		
10	30	Y	Х			Yes		
12	36	Ν	Х			Yes		
1. Outfall's reuse recommendation is based on the general condition of the outfall only. Further inspection/verifica								

# **APPENDIX B**

#### **2016 VIDEO SURVEY BY SUBDYNAMIC**

#### File Format:

Video Survey DVD #

- Video Survey Data Structure X to Y
  - Survey Report Structure X to Y (.pdf)
  - ◆ Survey Video Structure X to Y (.wmv)
- Archived Raw Video Survey Data from Subdynamic

# **APPENDIX C**

# **EXISTING 2014 VIDEO SURVEY BY SUBTRONIC**

#### **File Format:**

Video Survey DVD #

- Survey Photos
  - Raw Photo Data (.jpg)
- Survey Videos
  - ♦ Raw Video Data (.MPG)
- Survey Reports
  - Raw Report Data (.pdf)

# **APPENDIX D**

# EXISTING SEWER MAPS USED FOR REFERENCE (BY NAVY AND OTHERS

![](_page_33_Figure_0.jpeg)

![](_page_34_Figure_0.jpeg)

Appendix B to May 2021 Final SEA

Appendix B to May 2021 Final SEA

# **APPENDIX E**

# PHASE 1 SITE PLAN – PROPOSED EASEMENT MAP (BY OTHERS)

![](_page_37_Figure_0.jpeg)