SD Public Utilities

SOUTH BAY OCEAN OUTFALL ANNUAL INSPECTION REPORT 2012 – 2016

JANUARY 2018

Environmental Monitoring and Technical Services
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CERTIFIED
Public Utilities Department
Continual Improvement, Prevention of Pollution, Regulatory Compliance
ISO 14001

The City of
SAN DIEGO
Public Utilities Department
Environmental Monitoring & Technical Services Division

February 14, 2018

State Lands Commission
100 Howe Ave Suite 100
South Sacramento, CA 95825-8202

To whom it may concern:

Subject: South Bay and Point Loma Ocean Outfall Annual Inspection Surveys 2012-2016

Enclosed is the South Bay Ocean Outfall Annual Inspection Report covering calendar years 2012-2016 submitted in compliance with the conditions of Lease PRC 7888.9. The report has been certified by Mr. Richard Snow, a registered professional engineer in the State of California. The associated video files for each year's external inspection conducted using a remotely operated vehicle (ROV), on which much of this report is based, are available on the enclosed USB flash drive. A PDF copy of the report itself can also be found in a separate subdirectory on the flash drive. Future external inspections of the outfall pipe and diffuser structures will be continued on an annual basis unless the schedule is modified by mutual agreement of the respective parties.

In addition to the above, a second USB flash drive containing the Point Loma Ocean Outfall Annual Inspection reports and video from the 2012 through the 2016 surveys has been included for your review.

If you have any questions, please call Mr. Mike Kelly (Ocean Operations Supervisor) at (619) 758-2342, or Dr. Tim Stebbins (Senior Marine Biologist) at (619) 758-2329.

Sincerely,

Peter S. Vroom, Ph.D.
Deputy Director, Public Utilities Department

TS/mk

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The City of San Diego
MEMORANDUM

DATE: December 19, 2017

TO: Peter Vroom, Deputy Director Public Utilities

FROM: Richard Snow, P.E., Senior Civil Engineer

SUBJECT: South Bay Ocean Outfall 2012-2016 Annual Inspection Report

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Transmitted herewith is a copy of the report entitled "South Bay Ocean Outfall 2012-2016 Annual Inspection Report". This report presents a compilation of the results from the annual outfall external inspections conducted in 2012, 2013, 2014, 2015 and 2016, performed by staff of the City of San Diego.

In general, the findings of this surveys agree with the conclusions of earlier inspections: the ballast, the diffusers and the exterior of the outfall system are in good condition, with isolated areas along the North Diffuser Leg showing reduced rock levels. A side by side comparison of the videos from fiscal year 2012 and the 2016 inspections lends support to the theory that the areas of low ballast are a result of the original rock placement during the construction of the outfall. The ballast level along that diffuser leg and the rest of the outfall appears unchanged. The upgrade to secondary treatment at the South Bay International Wastewater Treatment Plant in January 2011 has improved the quality of discharged effluent drastically and may have been responsible for the elimination of the bacterial mats observed near the points of discharge in previous inspections.

I conclude that during the 2012-2016 external inspections, the South Bay Ocean Outfall appears to be in good condition overall. Should you have any questions or require additional information, I can be reached at x18321.

Richard Snow, P.E.

Attachment: South Bay Ocean Outfall 2012-2016 Annual Inspection Report

cc: Tim Stebbins, Senior Marine Biologist
Brent Bowman, Senior Chemist
Mike Kelly, Marine Biologist III
Juan Guerreiro, Deputy Director Public Utilities/ WWTD

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Section 1

General Introduction

This report summarizes the results of the South Bay Ocean Outfall (SBOO) annual inspections conducted from 2012 through 2016. Each inspection was completed by City of San Diego (City) Marine Biology Laboratory personnel using a remotely operated vehicle (ROV) to survey the external portions of the outfall pipe and diffuser structures. These surveys and this summary were completed to satisfy the maintenance and inspection requirements set forth in Lease No. PRC 7888.9 issued by the State of California State Lands Commission.

The 2012-2016 ROV surveys were conducted on the following dates:

SBOO Annual External Inspection Surveys (2012 – 2016)

- CY 2012 survey conducted April 24-27, 2012
- CY 2013 survey conducted December 9, 2013*
- CY 2014 Survey conducted September 23, 2014
- CY 2015 Survey conducted September 3, 2015
- CY 2016 Survey conducted September 8, 2016

* *The 2013 inspection was repeated on April 29, 2014 because of corruption of the original survey video due to a hard drive failure.*

1.1 Inspection Method

The SAAB Seaeye Falcon ROV, acquired by the City in September 2011, was used for every SBOO inspection over the 5-year period covered by this report. The ROV came equipped with a high sensitivity Seaeye color video camera and an Insite Pacific Mercury ultra-low light black and white video camera. The system is also equipped with a digital sonar and an ultra-short baseline tracking system, which uses acoustic telemetry to locate the position of the ROV relative to the support vessel in real time.

Each inspection involved surveying the visible and buried underwater, exterior portions of the outfall, the South Diffuser Leg termination structure (terminus), the South Diffuser Leg, the Wye, the North Diffuser Leg and termination, the Main Barrel and the manhole covers and maintenance access hatches (numbered 6 to 1 proceeding inshore), and the riser assembly shield (see Figure 1 in Appendix A).

The inspections began at the South Diffuser Leg terminus and proceeded north toward the Wye over each of the diffusers to inspect the structural condition and function of the riser assemblies. At the Wye, the three gate covers were inspected and then ROV was flown offshore to the end of the rock pile covering the short three pipe section terminal extension of the outfall The vehicle was then returned to the Wye to begin the survey of the North Diffuser Leg. As the ROV was flown over the diffuser leg, it was paused briefly to inspect each of the blind flanged riser

assemblies. At the end of the diffuser leg the condition of the terminus was inspected. From there the ROV was repositioned at the center Wye where it was directed inshore to inspect condition of the ballast rock and the manhole covers and access hatches spaced at uniform intervals along the main barrel.

The video records are being provided on a USB flash drive to enable a reviewer faster access to all aspects of each survey. This format assists in the evaluation of the condition of the outfall being reviewed to that observed in other surveys. A directory of the contents of the flash drive is presented in Appendix B.

1.2 Monitoring Vessel

The Cityôs *M/V Oceanus* is a 48-foot, twin diesel engine-powered, aluminum hull, modified crew boat, with a rear-mounted hydraulic A-frame and a bow winch from which the clump weight is deployed. The vessel is used by the Public Utilities Departmentôs Environmental Monitoring and Technical Services Division primarily as an ocean monitoring and outfall inspection platform.

1.3 Positioning

The vessel was initially moved near the outfall during each survey to deploy the ROV using a Global Positioning System (GPS). Once in the water, the ROV was kept on the surface and moved to a distance of about 200 ft from the bow. The umbilical tethered to the ROV was incrementally fastened to a wire holding a 200 lb. clump weight. As the clump weight was slowly lowered to depth of 30 ft above the bottom, the ROV simultaneously descended to the seafloor. The ROVôs sonar was then used to locate the outfall structure and then it was moved to the terminus of the South Diffuser Leg to begin the inspection.

1.4 Potential Survey Limitations

Certain limitations can be associated with any underwater inspection, which may ultimately reduce survey image quality and accessibility to fine structural detail. Some of these limitations may include reduced water clarity, technical issues with the ROV, and visual obstruction of specific structural features. Such factors may reduce detection capabilities, and therefore the ability to fully analyze, assess, and make the correct judgments and recommendations.

Section 2

South Bay Facility Description and Background

The SBOO discharges commingled effluent from the Cityôs South Bay Water Reclamation Plant (SBWRP) and the South Bay International Wastewater Treatment Plant (SBIWTP) that is owned and operated by the U.S. Section of the International Boundary and Water Commission (IBWC). The areas served by these facilities include eastern Tijuana, tributary to Tijuanaôs Pump Station Number One, San Ysidro, and other local South Bay communities, tributary to the Grove Avenue Pump Station.

Construction of the South Bay Land Outfall (SBLO) began in 1991 and was finished in 1994. Building the offshore portion of the SBOO commenced during the fourth quarter of 1995 and effluent began discharging from the SBIWTP on January 13, 1999. The SBWRP went online and began discharging effluent via the SBOO on May 6, 2002.

The SBOO discharges the combined effluent at a location of approximately 3.5 statute miles off the coast of Imperial Beach, CA, at an approximate depth of 90 feet below mean sea level and at a minimum initial dilution of 100:1 (see Figure 1 in Appendix A). The partial tunnel/partial conventional seafloor configuration was chosen because overall construction and environmental mitigation costs were lower than other available options. It is important to note that the tunnel does not extend all the way to the diffusers due to the westerly drop off of the San Diego Formation (SDF), a favorable tunneling geology. Lowering the tunnel to remain within the SDF would have exceeded the realm of tunneling technology at the time of construction. Therefore, the decision was made to construct a riser assembly conduit at one of the offshore boring locations and to also build a conventional seafloor configuration in order to achieve the desired depth and location for effluent discharge.

Construction of the SBOO consisted of three contracts as follows: (1) the special upstream structures; (2) the drop shaft, tunnel and riser assembly; and (3) the offshore portion beyond the riser assembly. In contrast, the SBLO consisted of one construction contract.

Some of the capabilities of the SBOO include: effluent distribution; emergency and controlled Tijuana River channel effluent discharge; return of effluent to Mexico; excess potential energy dissipation; back-flow prevention and conduit isolation for energy dissipation baffle and conduit maintenance; enhanced entrained air and gas removal; SBLO back-flow prevention during high-tide and low-flow conditions; maintenance access, corrosion monitoring and reduction measures; outfall back pressure detection, monitoring and recordation capabilities; conduit flushing; and outfall extension.

2.1 Outfall Description

The SBOO initiates from a drop shaft on land approximately 1 mile inland from the ocean. The shaft drops vertically to a depth of 159 feet below sea level (MLLW; top of pipe) and proceeds offshore in an underground tunnel. The tunnel is 132 -inch in diameter and follows the seabed grade at a slope of -0.3522% to a depth of approximately 214 feet (MLLW; top of pipe). The tunnel ends approximately 19,000 feet from the drop shaft, where the riser structure begins and heads to the surface.

The seafloor portion of the SBOO was constructed by excavating a trench, then simultaneously placing the bedding stone and the pipe. Once that was completed, ballast and armor rock were added to the structure. The only visible features of the outfall include the armor rock, the riser assembly shield, the six hatches along the main barrel, the gate covers of the wye structure, the diffuser riser assemblies, and the diffuser leg termination structures.

The outfall is approximately 4,691 feet long from the center of the riser shaft to the center of the diffuser wye (see Figure 2 in Appendix A). The 120-inch inside diameter (I.D.) seabed pipe was constructed by excavating a trench, then simultaneously placing the bedding stone and the pipe sections. The pipe sections are constructed of reinforced concrete, bell and spigot pipe of the raised bell type, with two gaskets at each joint. The bells of the pipe face offshore. The pipe sits on a bedding of class 3 stone which is covered with a minimum of 1 foot of class 2 ballast/filter stone, followed by a 3.5 foot armor layer of class 1 stone (see Figure 3 in Appendix A). The alignment of the main barrel of the outfall is approximately 210Á- 215Á, starts at a depth of 71 feet (MLLW) and ends in approximately 90 feet (MLLW).

The main barrel is completely covered in ballast rock, with the exception of the Inshore Riser Cover, the six maintenance access hatches (manholes), the diffuser risers, and the diffuser termination structures. The first manhole (Station 190 + 30) is located in the center of the first pipe section next to the riser shaft (see Figure 4 in Appendix A). There is a 2-foot diameter opening with a lid in the center of the riser. Armor stone is piled over the outfall pipe to just below the riser cover. Inside the riser is an air relief assembly that bleeds off excess air from the outfall pipe. There is a maintenance access hatch inside the riser that opens to the seabed pipe. The rest of the manholes are built the same and accessed through risers (see Figure 5 in Appendix A). A 10-inch thick reinforced concrete cover seals the 7 foot 6 inch outside diameter (O.D.) riser. Three lifting hooks are used to open the cover. The maintenance access hatch is located inside the riser. Approximately 5 feet of stone covers the seabed pipe around the riser cover.

The distance between each manhole is 926 feet (Ñ10 feet) (Table 1). The last manhole is located on the first pipe section inshore of the diffuser wye (W).

Table 1. Manhole locations on the South Bay Ocean Outfall

Manhole*	Latitude	Longitude
1	32Á32.3439	117Á10.0918
2	32Á32.3255	117Á10.2855
3	32Á32.3089	117Á10.4636
4	32Á32.2930	117Á10.6414
5	32Á32.2760	117Á10.8197
6	32Á32.2591	117Á10.9988

* Manhole No. 1 is offshore of the Inshore Riser Cover and Manhole No. 6 is immediately inshore of the diffuser at the Wye.

The diffuser legs branch off from the main seabed pipe at the diffuser wye (Station 236 + 98.67) (see Figure 6 in Appendix A). The length of the diffuser wye section from bell end to bell end is 52 feet along the main axis of the seabed pipe. The angles between the north and south diffuser leg centerlines on the offshore ends and the wye structure centerline is 77Áand 74Árespectively. The approximate alignments of the north and south diffuser legs are 340Áand 185Árespectively.

A 40 foot long offshore extension is connected to the diffuser wye and is completely buried under rock armor. A concrete pipe end plug seals the end of the pipe at Station 237 + 63.54. If the outfall were ever to be extended, it would begin at this section.

There are three gates that can be used to stop flow between the main seabed pipe and diffuser legs and pipe end. The North Diffuser Leg and Offshore Extension gates are currently in place. Two Monel lifting hooks (1.5 inch diameter, 6 inch radius) are provided on each gate for their removal.

The length of each diffuser leg is 1,981 feet from the end of the termination structure to the Wye centerline. The diffuser sections are 84 inch I.D. where they connect to the diffuser wye (Station 0 + 00). At Station 6 + 00 a 24 foot transition section reduces the pipe diameter to 72 inches I.D. Another 24 foot transition section at Station 12 + 24 further reduces the pipe diameter to 52 inch I.D. The north and south diffuser legs end at Station 19 + 81.00 and Station 19 + 80.98, respectively. A 30-foot termination structure seals the end of each diffuser leg (see Figure 7 in Appendix A) and a flap gate seals the 42-inch I.D. pipe section of the termination structure. Rock ballast covers all of the termination structure, except for the flap gate and concrete support for the termination pipe.

Since the diffuser legs are buried, effluent from the outfall enters the ocean through diffuser riser assemblies which are bolted to the top of the diffuser leg conduits and to the wye structure. The effluent rises vertically through the high-density polyethylene diffuser risers and transitions to horizontal discharge from a 1 foot 7.5 inch diffuser head with four ports. Each diffuser riser assembly is provided with a surrounding canister which protects it from the adjacent rock, and vessel anchors (see Figure 8 in Appendix A).

There are 165 diffuser riser assemblies on the outfall; 82 on each diffuser leg and the one at the wye structure. The risers are numbered sequentially, beginning at the wye structure and referred to with either ñNò or ñSò prefixes to indicate placement on the north or south diffuser legs. Thus, N1 is located adjacent to the wye structure and N82 is located at the far end of the north diffuser leg. The diffuser riser at the wye structure is simply designated as ñWò. The riser assemblies can be open (a head with four open and free-flowing ports), capped (a head with four temporarily-closed ports), or blind flanged (no head with a blind flange bolted to the upper flange of the riser assembly (Table 2).

Table 2. Current Diffuser Riser Configuration

	Open (Flow)	**Capped (Temporarily Closed- No Flow)**	**Blind Flanged (No Flow)**
North Diffuser Leg			N1 - N82
South Diffuser Leg	S26, S52, S68 - S82	S51, S53 - S67	S1 - S25, S27 - S50
Wye Structure	W		
Number	18 Diffuser Risers (72 ports)	16 Diffuser Risers (64 ports)	131 Diffuser Risers (no ports)
Percentage	10.91 %	9.70 %	79.39 %

2.2 Flowrate Allocation and Ownership

The as-designed allocation of outfall flowrates and outfall ownership are as follows:

	IBWC	**City of San Diego**	**Total**
Average Flowrate	100 mgd	74 mgd	174 mgd
Peak Flowrate	200 mgd	133 mgd	333 mgd †
Ownership *	60.06 %	39.94 %	100 %

* Ownership of the South Bay Ocean Outfall is as shown, and is based upon the peak flowrates, however, ownership of the South Bay Land Outfall is shared equally.

† The total peak flowrate is based upon the addition of a future pump station. At present, the maximum gravity flowrate through the outfall is 258 mgd.

2.3 Operation and Maintenance Responsibilities

A Memorandum of Understanding (and two subsequent Amendments) between the IBWC and the City was drafted which summarizes the outfallï related operation and maintenance responsibilities. Briefly, the IBWC is responsible for the land outfall east of the drop shaft, including the anti-intrusion structure and two valves which are located on top of the drop shaft hatch cover, and the City is responsible for the drop shaft and everything west of it, including all of the offshore components.

2.4 Post Start-up Corrective Work

Since the initial start-up of the outfall in early 1999, the City has administered two offshore corrective work sessions and one onshore corrective work session. The offshore work sessions involved: (1) the installation of two Monel plugs, each, in the maintenance access hatch covers 2, 3, and 4 to halt effluent leakage; and (2) the temporary closure of 64 ports along the South Diffuser Leg. Corrective work onshore included sealing the hatch covers on the anti-intrusion structure and the drop shaft, sealing the concrete at the anti-intrusion structure, improving overall structural anti-corrosion measures, and finally, conducting minor induced pressure testing.

2.5 Administrative Details

The SBOO as-built Mylar drawings are located on the Fifth Floor of the City of San Diego Development Services Department - Engineering Maps and Records Office, which is located at 1222 First Avenue; Mail Station 501; San Diego, CA 92101. Access can be arranged for reproduction capabilities, as required.

Section 3

External Survey Observations

3.1 General Observations

After careful review of the video recordings for each of the five inspections and a side by side comparison of the 2012 and 2016 survey videos, it appears the overall structure of the outfall has changed very little over time. The water clarity varied from survey to survey as did the type and extent of algal and invertebrate growth on the ballast rock, the riser assemblies and the other exposed features of the outfall. However, the distribution of ballast rock along the outfall and indeed the placement of individual stones surrounding each riser assembly seemed nearly identical from survey to survey. The canting, or leaning of certain riser heads on the North Diffuser Leg observed in earlier inspections also seemed unchanged. If any change had occurred in the incidence among the riser assemblies and the direction and the extent of the canting of individual riser heads between 2012 and 2016, it was undetectable.

3.2 Annual Surveys

2012 Survey

This survey was initiated on April 24th and concluded on April 27th, 2012. Surface conditions were generally calm, but the prevailing 10-15 knot surface winds made maintaining vessel position a challenge. Water clarity was very poor this year, limited to 10 or fewer feet of horizontal visibility. The SBIWTP treated effluent at a secondary level during this period, thereby making the discharge from the effluent nearly colorless. While the increased level of treatment was a welcome improvement, identifying leaks became more difficult as small discharges of clear effluent were very difficult to see. The telltale white bacterial mats generated by the lower quality effluent prior to 2010 were generally no longer observed.

Overall, the outfall was found to be in good condition and seemed relatively unchanged from earlier inspections.

South Diffuser Leg: The termination structure was in good condition. The flap gate was not observed to be leaking and the anode retained approximately 50% of its original mass. The 17 active diffuser heads were all overgrown with colonial invertebrate organisms. The southeast port on diffuser S82 appeared to be blocked by that growth, but the other three were flowing. The flow from the southwest port on S73 appeared to be constricted by the invertebrate growth, but the others were flowing normally. The other 15 active diffuser heads were functioning properly and no other obstructions to any of the four diffuser ports were observed. The remaining capped (temporarily closed diffuser head) and the blind flanged diffuser assemblies were inactive. The ballast coverage along the entire leg seemed unchanged since the original rock

placement and the levels surrounding all 82 riser assemblies were at or near the top of the protective containers.

Wye: The South Leg Gate Cover was sealed properly and damage free. The small crescent shaped section missing from the lower offshore edge of the upper Offshore Extension Gate Cover was still evident, but the remainder of the structure was in good condition and not leaking. The ballast rock (rock pile) covering the offshore terminal extension of the outfall seemed unchanged and the coverage was total. The white bacterial mat seen in former surveys on the north side of the rock pile was not observed this year. The missing northeast corner of the North Leg Gate Cover was also still evident, but there was no additional damage anywhere else. The discharge of bubbles seen in earlier inspections was not present this year. The active diffuser W at the center of the Wye was overgrown with colonial invertebrates, but all four diffuser ports were discharging effluent normally.

North Diffuser Leg: The blind flanged riser assemblies all seemed to be properly sealed this year. The telltale signs of seepage at riser N69 (e.g., lack of sediment accumulation at the riser base, white patina of bacteria in the riser can) noted in former surveys was not observed this year because the ROV was inadvertently pulled off the outfall around N69. When the vehicle was repositioned, that riser was unintentionally overlooked. Ballast coverage along the entire diffuser leg and around the individual riser assemblies was adequate and seemed unchanged. Sand intrusion along the northern half of the diffuser leg was still present, but the overall level and extent of the coverage appeared unchanged from earlier inspections. The termination structure was in good condition, the anode was approximately 50% or less of its original mass and the flap gate was not leaking.

Main Barrel: Manhole 6 was lightly overgrown by algae and was easily observed. The concrete and the lifting eyes were in original condition and the seam was properly sealed. Manhole 5 was more overgrown with algae, making it somewhat difficult to see and evaluate. The southern lifting eye was bent inwards, but no other damage to the cover was detected and it was not leaking. Manhole 4 was generally in good condition and was sealed properly. The chipped section on the western edge of the cover of Manhole 3 was still evident, but the rest was in good condition and the lifting eyes were undamaged. The coverage of understory algae on Manhole 2 made it difficult to evaluate, but the cover was not leaking and looked to be in good condition. The Air Relief Valve (mislabeled MH2), and the Inshore Riser Cover (mislabeled MH1) were both sealed properly and in good condition.

2013/2014 Survey

This survey was initially conducted on December 9, 2013, but was repeated on April 29, 2014 due to a catastrophic failure of the hard drive on which the video files were stored. Therefore, the observations summarized below are based on review of the April 2014 survey.

Surface conditions were calm and the water clarity was improved over last year, thus enabling the crew to complete the entire survey in about four hours. The outfall was found to be in good

condition overall. Structurally it appeared unchanged and apart from the progressive accumulation of invertebrate growth on the 27 active diffuser heads, the outfall seemed to be functioning normally. There was more understory algae carpeting the Center Wye and the Main Barrel areas of the outfall than had been observed in previous inspections. This new development made identifying and inspecting some of the exposed structures, such as the manholes, difficult compared to earlier surveys.

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South Diffuser Leg: The termination structure and the flap gate were in good condition with no detectable leaking. The anode on the flap gate crossbar had retained approximately 50% of its original mass. The size of the invertebrate colonies on the 17 active diffuser heads had grown noticeably during the past year. In many instances these colonies had formed tubes around the actively discharging ports. The southeast port on S82 was still completely blocked by the organisms, but the other three ports continued to flow freely. The southwest port on S73 was flowing but remained partially obstructed by the invertebrate growth. The diffuser ports on the other active diffuser heads appeared to be functioning normally. City engineering staff confirmed this assumption by saying there was no record of a sustained increase in backpressure in the outfall. The 65 inactive risers were in good condition and were sealed properly. Ballast coverage along the entire leg and around each riser seemed unchanged.

Wye: The three gate covers were found to be largely overgrown with algae and invertebrates this year, but appeared to be in good condition and were sealed properly. The offshore rock pile covering the terminal extension of the outfall seemed unchanged and free of any telltale signs of leaking. The active diffuser W at the center of the Wye was flowing normally, but like many of the other the active diffuser heads, tubes had formed around he diffuser ports from the accumulated growth of colonial organisms.

North Diffuser Leg: Apart from the evidence that riser N69 continued to seep effluent, the risers on this structure appeared to be in good condition and remained properly sealed. Ballast coverage along the entire diffuser leg and around the individual riser assemblies was complete and seemed unchanged. The persistent sand intrusion along the northern half of the diffuser leg seemed little changed from that observed in prior surveys. The termination structure was in good condition, the anode was approximately 50% or less of its original mass, and there was no indication of leaking at the flap gate.

Main Barrel: Ballast coverage along the entire length of this structure was complete except for the seven exposed manhole covers. Manhole 6 (immediately inshore of W) was heavily overgrown by algae, making a thorough evaluation difficult. The manhole covers inshore of that were either clear or only partially covered by algal growth. All five of the concrete manhole covers and their metal lifting eyes appeared unchanged from earlier surveys. The condition of the concrete Air Relief Valve cover (MH1) and the Inshore Riser cover was also unchanged. None of the covers exhibited any signs of seepage and were, therefore, assumed to be properly sealed.

2014 Survey

This survey was conducted on September 23, 2014. Surface conditions were generally calm. The horizontal water clarity averaged 25-30 feet or more in the offshore areas and was reduced to a range of 15-5 feet of visibility as the survey progressed inshore along the Main Barrel. The amount of understory algae growing on the outfall had increased markedly since the previous inspection five months earlier (i.e., April 2014), which made identifying and inspecting some of the exposed structures (risers, concrete manhole covers, etc.) difficult. The outfall, however, was found to be in good overall condition, structurally unchanged and functioning normally despite increased accumulation of invertebrate growth on the diffuser heads.

South Diffuser Leg: The termination structure and the flap gate were overgrown with algae and colonial invertebrates, but looked to be in good condition and did not exhibit any signs of leaking. The anode on the flap gate crossbar was difficult to evaluate due to the encrusting growth. The southeast diffuser port on riser S82 was still completely blocked, but the other three ports were flowing normally. The formerly constricted southwest port on S73 was seen to be flowing at the same rate as the other ports on the head. The other active diffuser heads had all accumulated more invertebrate growth this year, but their diffuser ports all looked to be flowing freely. The inactive risers were all in good condition and were sealed properly. The ballast coverage along this structure also seemed unchanged.

Wye: Apart from the increased coverage of algae on the gate covers and the offshore rock pile, there were no noticeable differences compared to observations made in earlier inspections. Diffuser W continued to flow normally, but like many of the other the active diffuser heads tubes of colonial organisms surrounded the diffuser ports.

North Diffuser Leg: Ballast coverage along the entire structure and around the individual riser assemblies was unchanged. The risers themselves appeared to be properly sealed except for N69, which still appeared to be leaking as evidenced by the patina of white bacteria. The sand intrusion along the northern half of the diffuser leg was still present, but the overall distribution of the coverage had again not changed noticeably. The termination structure was in good condition and seemed to be properly sealed. The anode on the crossbar was difficult to see, and therefore could not be fully evaluated.

Main Barrel: Understory algae covered much of the Main Barrel this year, but the ballast coverage seemed complete and looked no different from earlier inspections. All the concrete access covers except for Manhole 3 were heavily overgrown by algae and somewhat difficult to see. From what could be observed, however, all seven covers appeared to be in good condition and absent of any signs of leaking.

2015 Survey

The survey was conducted on September 3, 2015. The horizontal water clarity was very good, averaging 30-40 feet on the South Diffuser Leg, 20-25 feet on the North Diffuser Leg and 10-15

feet on the Main Barrel. The understory algae was still present during this year, but was found to be most dense in the areas without an active discharge of effluent. This again made locating and inspecting a number of the exposed structures challenging but not impossible. The outfall was generally observed to be in very good condition with no detectable differences from that observed in earlier surveys.

South Diffuser Leg: The terminus remained covered by invertebrate and algal growth, but looked to be looked structurally unchanged and absent of any visible leaking. The anode on the crossbar securing the flap gate was present but obscured by the encrusting biota and thus could not be evaluated. The southeast diffuser port on riser S82 was open this year and like the other three ports on the diffuser head looked to be flowing normally. The other active diffuser heads all looked to be flowing freely. The inactive risers were sealed properly and remained in good condition. The ballast coverage along this structure was unchanged.

Wye: The gate covers looked no different than during the previous survey and appeared to be sealed properly. The offshore rock pile was carpeted with algae, but the ballast coverage of the structure was complete and did not seem any different from earlier inspections. Though diffuser W was covered with more invertebrates this year, the ports all seemed to be discharging normally.

North Diffuser Leg: Ballast coverage along the entire structure was complete and appeared to be no different from earlier surveys. The amount of algal growth on this structure made locating the risers difficult, but they all appeared to be in good condition. Riser N69 continued to exhibit historical signs of leaking, a white patina of bacteria and the absence of sediment in the riser can, but otherwise looked to be structurally sound. The sand intrusion along the northern half of the diffuser leg was present, but seemed no different from past years. The termination was structurally intact and properly sealed. The anode on the crossbar was difficult to inspect, thus its status could not be determined.

Main Barrel: Understory algae covered much of the Main Barrel again this year. The ballast coverage was complete and seemed no different from past observations. All the concrete access covers except for Manhole 4 were heavily overgrown with algae and difficult to see, but they all looked to be in good condition and sealed properly.

2016 Survey

This survey was conducted on September 8, 2016. The water clarity was workable, averaging 15-20 feet of horizontal visibility in the offshore area and becoming 10 feet or less while moving inshore. The understory algae was still present, primarily in the areas without an active discharge, but was found to be in much lower densities than in 2015. The outfall was generally in very good condition with no detectable differences from what had been observed in earlier inspections.

South Diffuser Leg: The termination structure and the flap gate remained overgrown by algae and invertebrate growth, but generally appeared to be in good condition. The gate did not exhibit any visible signs of leaking. The anode on the crossbar could not be evaluated again this year because it was obscured by encrusting growth. The southeast diffuser port on riser S82 was still completely blocked, but the other three ports were flowing normally. The other active diffuser heads had accumulated more invertebrate growth since the last inspection, but their diffuser ports all looked to be flowing freely. The inactive risers were all in good condition and were sealed properly. The ballast coverage along this structure was unchanged.
Wye: The situation here was nearly identical to the previous survey in 2015: the gate covers were in good condition and were sealed properly, the offshore rock pile was somewhat covered in algae, but the ballast coverage was compete and diffuser W had accumulated more colonial organisms, but the ports all seemed to be discharging normally.

North Diffuser Leg: The ballast covering this structure had not visibly changed. The risers were all in good condition and apart from riser N69 were properly sealed. N69 continued to exhibit the telltale signs of leaking described in earlier surveys. The persistent intrusion of sand along the northern half of the diffuser leg seemed no different from past years. The termination structure remained in good condition and was properly sealed. The anode on the crossbar was difficult to see, thus its condition could not be evaluated.
Main Barrel: Understory algae was present this year but in densities much lower than observed in the previous three years. The ballast coverage was complete and seemed no different from earlier observations. The condition of all seven concrete access covers also seemed unchanged.

Section 4

Conclusions

Based on the findings summarized in Section 3 of this report for the South Bay Ocean Outfall, the specific conclusions reached as a result of the investigations are as follows:

- The SBOO has remained in overall good condition over the past five annual surveys and continues to be structurally and functionally sound;

- Ballast coverage on the SBOO has remained adequate and appears unchanged;

- The side by side comparison of the 2012 and the 2016 ROV inspection videos confirms that there has been no detectable change in the rock distribution over the North Diffuser Leg and also supports the notion that the localized areas of low rock distribution observed on this structure was likely an artifact of the construction process and not the result of external oceanographic forces;

- Sand intrusion from offshore along the northern half of the North Diffuser Leg has persisted throughout the inspection period and does not appear to have posed any functional impairment to the outfall structure;

- The active diffuser heads progressively accumulated larger colonies of invertebrate organisms over the 5-year review period, but their diffuser ports have remained generally unobstructed and the structures all appear to be functioning properly;

- The capped and blind flanged riser assemblies were observed to be in good condition and appear unchanged;

- Changes in the cosmetic damage to some of the concrete cover structures noted in earlier surveys were undetectable and the structures appeared to be fundamentally sound;

- The leaking noted in some of the concrete covers prior to the 2012 inspection were not evident throughout the entire 2012-2016 review period;

- The upgrade to secondary treatment at the IWTP in January 2011 has continued to markedly improve the visible quality of discharged effluent and may have also been responsible for the virtual elimination of the bacterial mats seen near all points of discharge in the years predating the current review period.

APPENDIX A

FIGURES

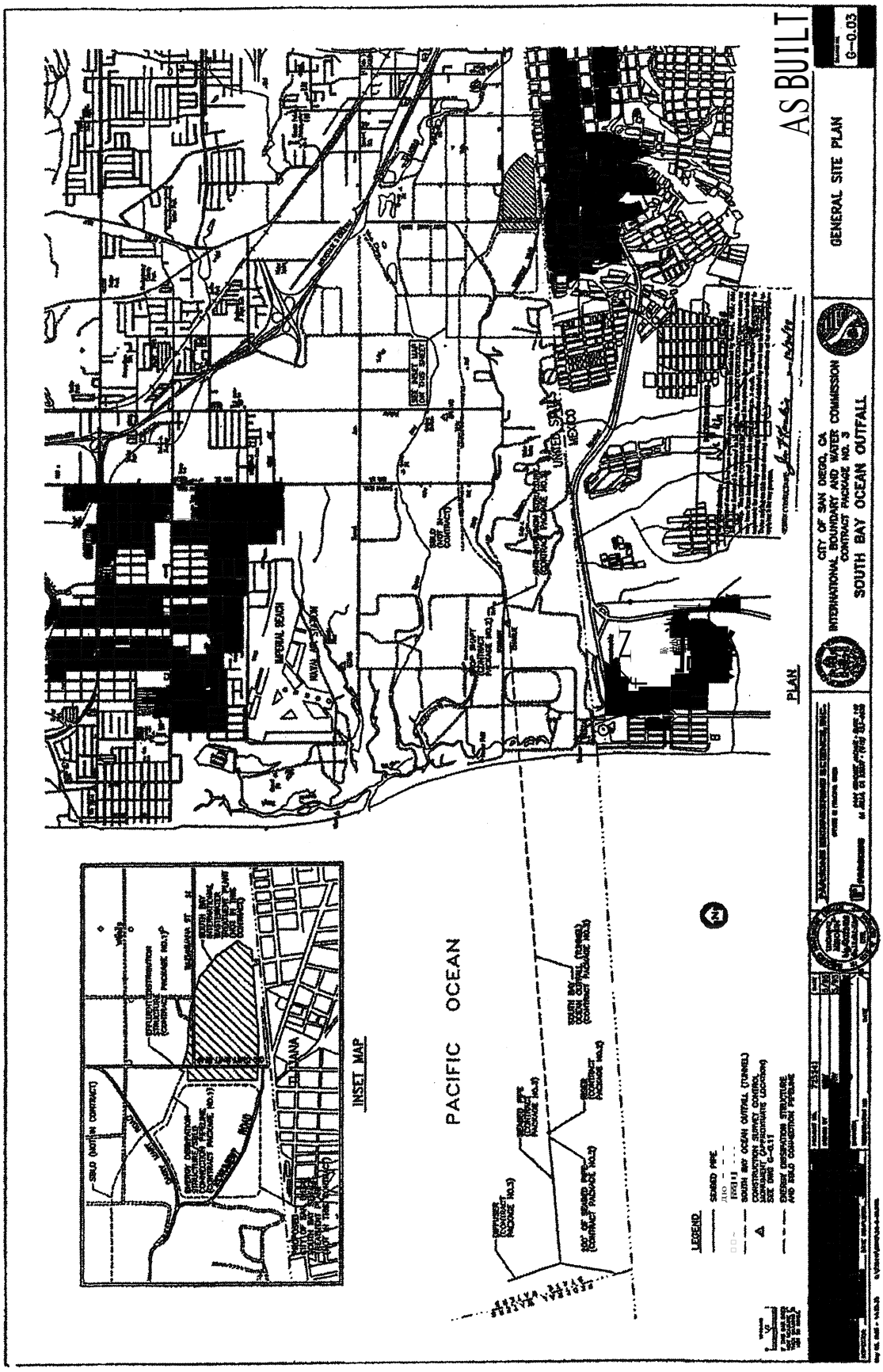


Figure 1. Map of the land and ocean based portions of the South Bay Ocean Outfall.

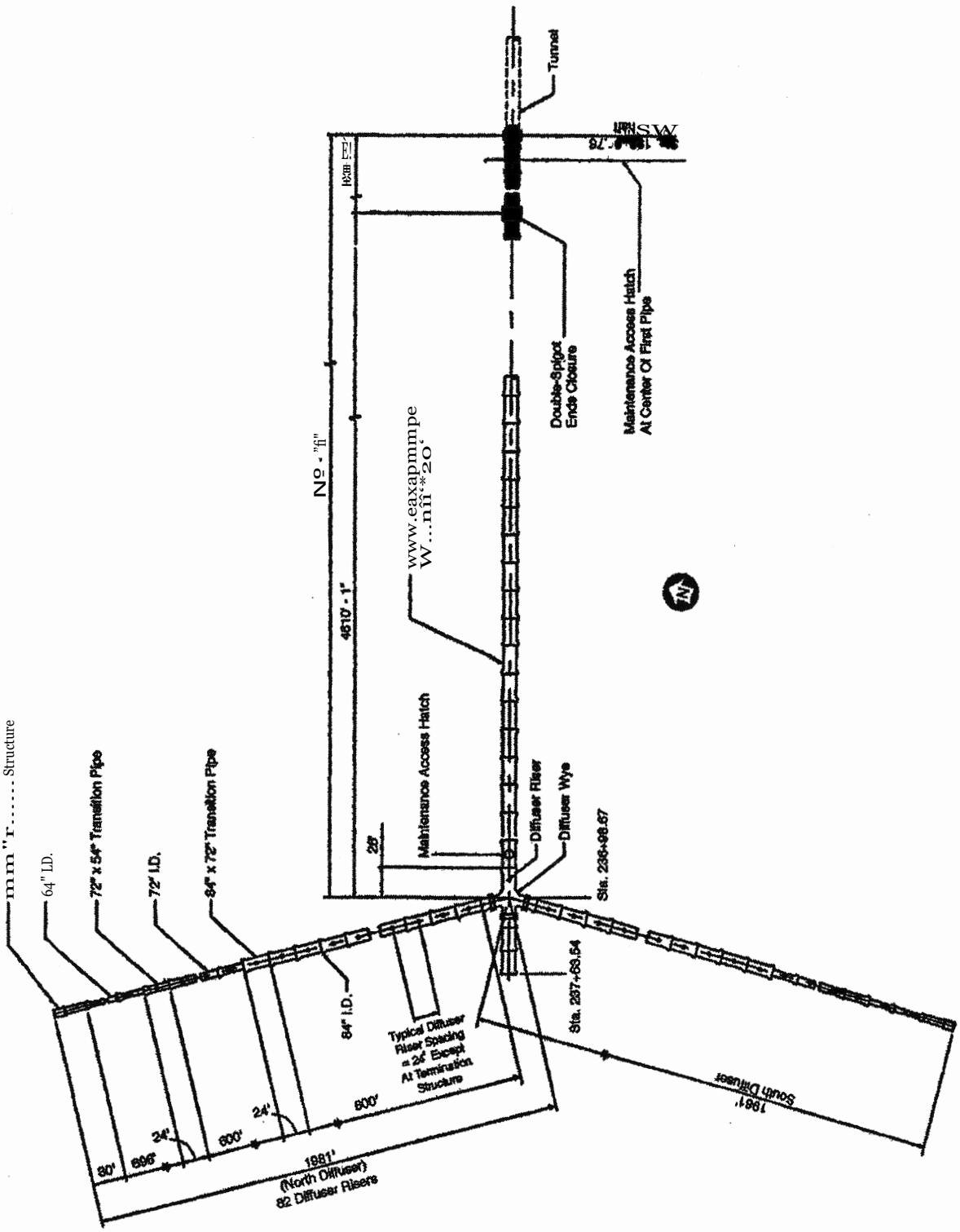
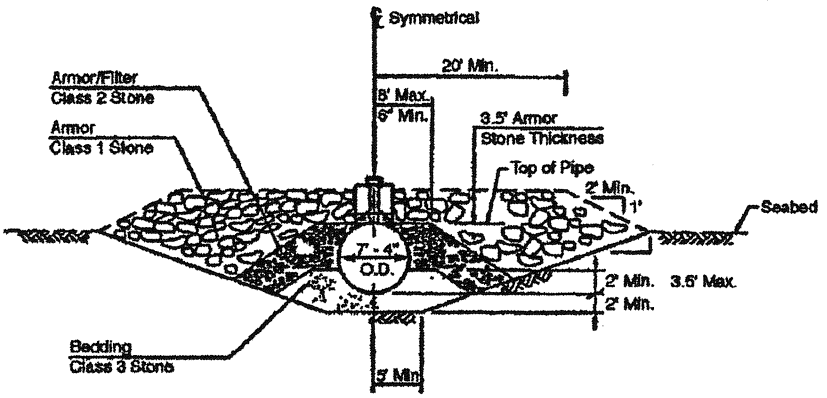
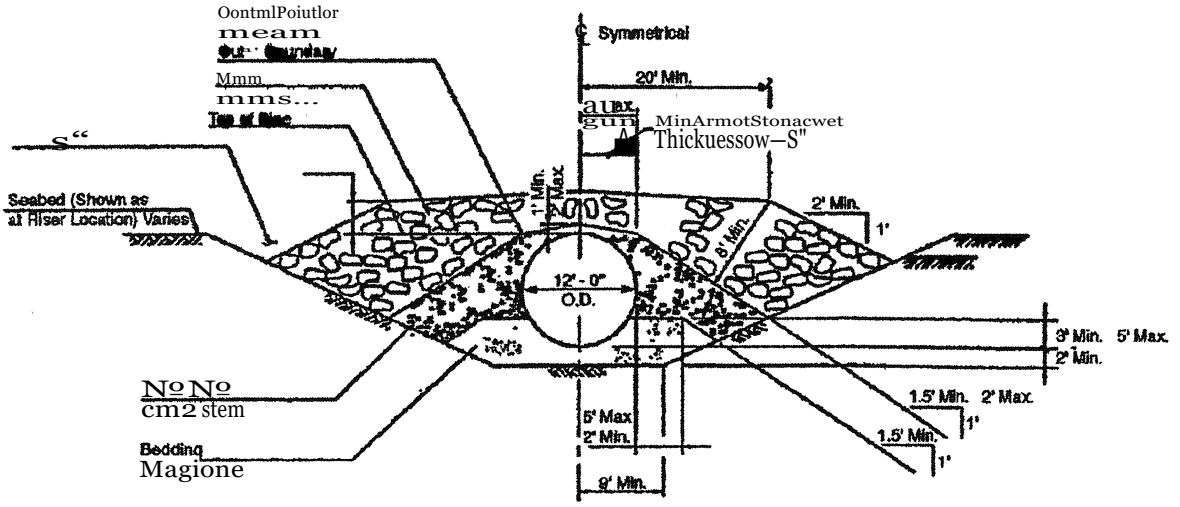


Figure 2. The South Bay Ocean Outfall seabed pipe and diffusers.



72 - inch LD. Diffuser
mmm»



120 ˜ топ LD. Seabed Pipe
Not to Scale

Figure 3. Cross-section of the South Bay Ocean Outfall and ballast rock.

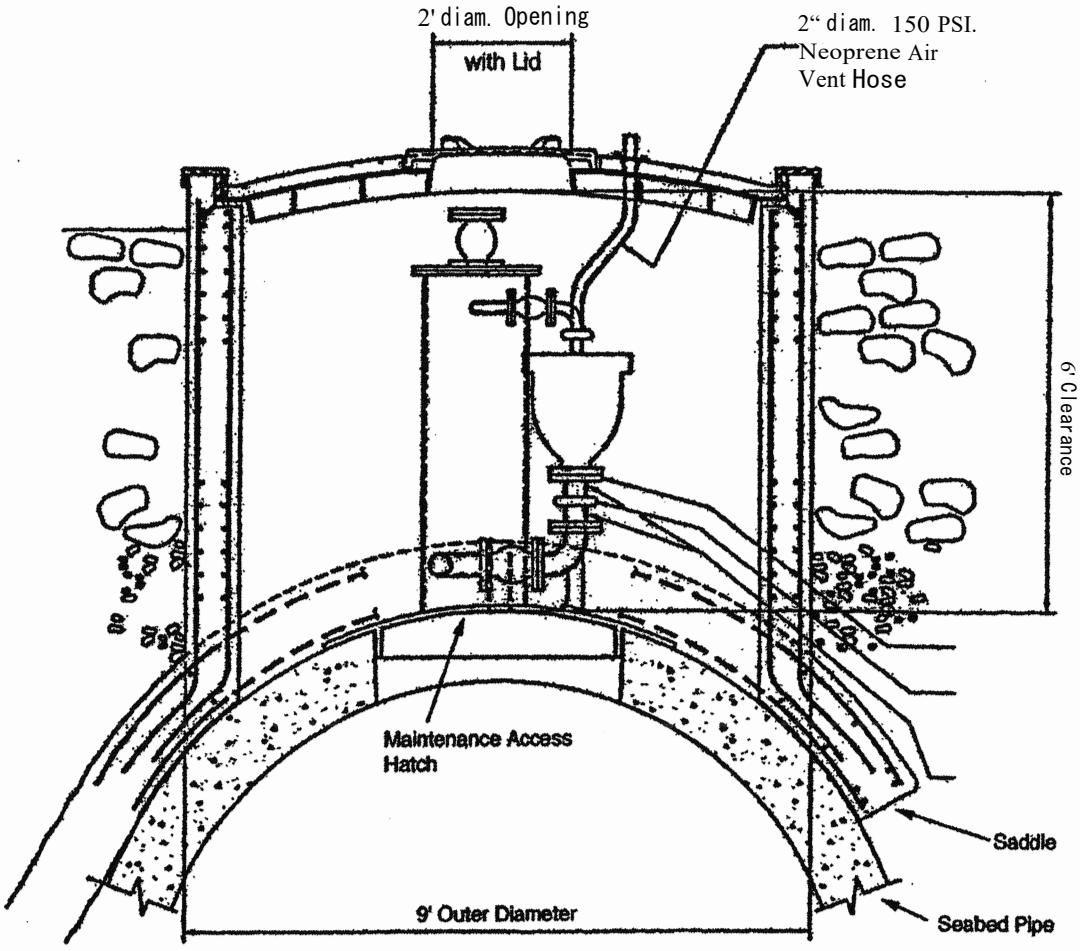


Figure 4. Air relief assembly and maintenance hatch for the South Bay Ocean Outfall.

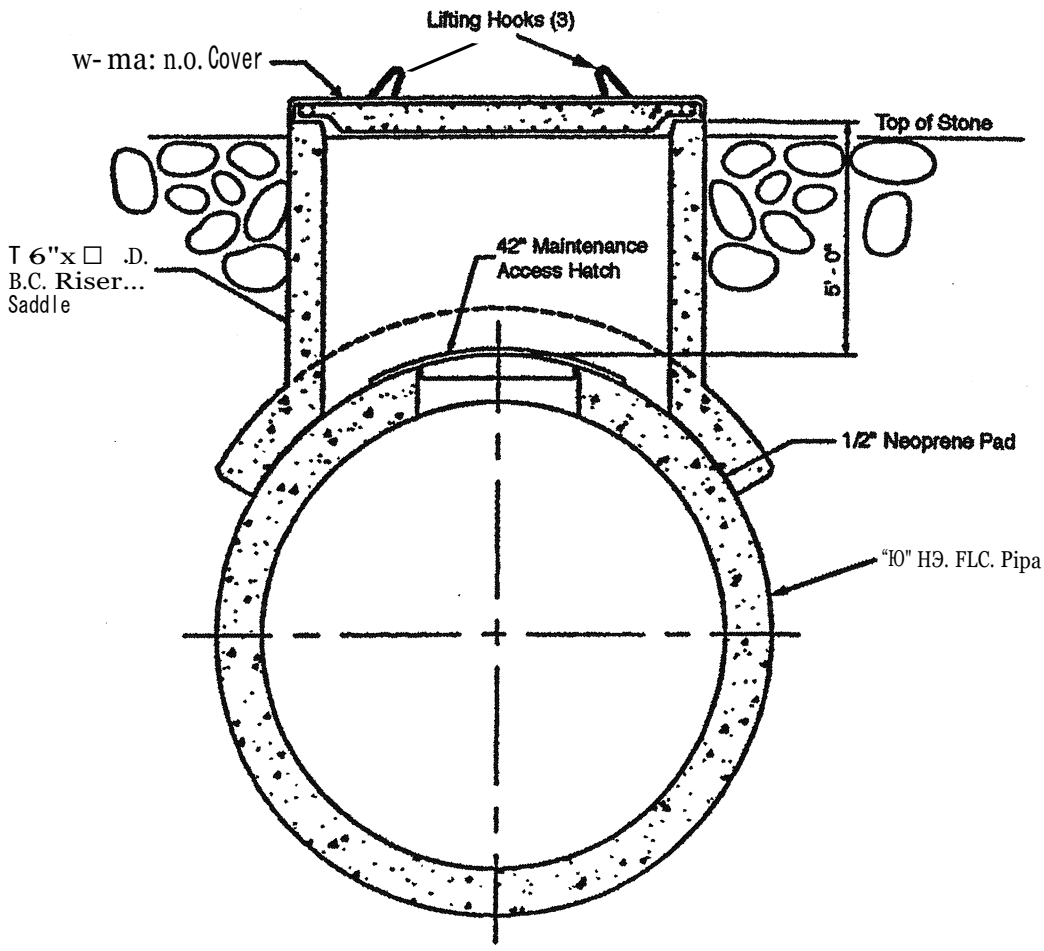


Figure 5. Maintenance access hatch and riser for the South Bay Ocean Outfall.

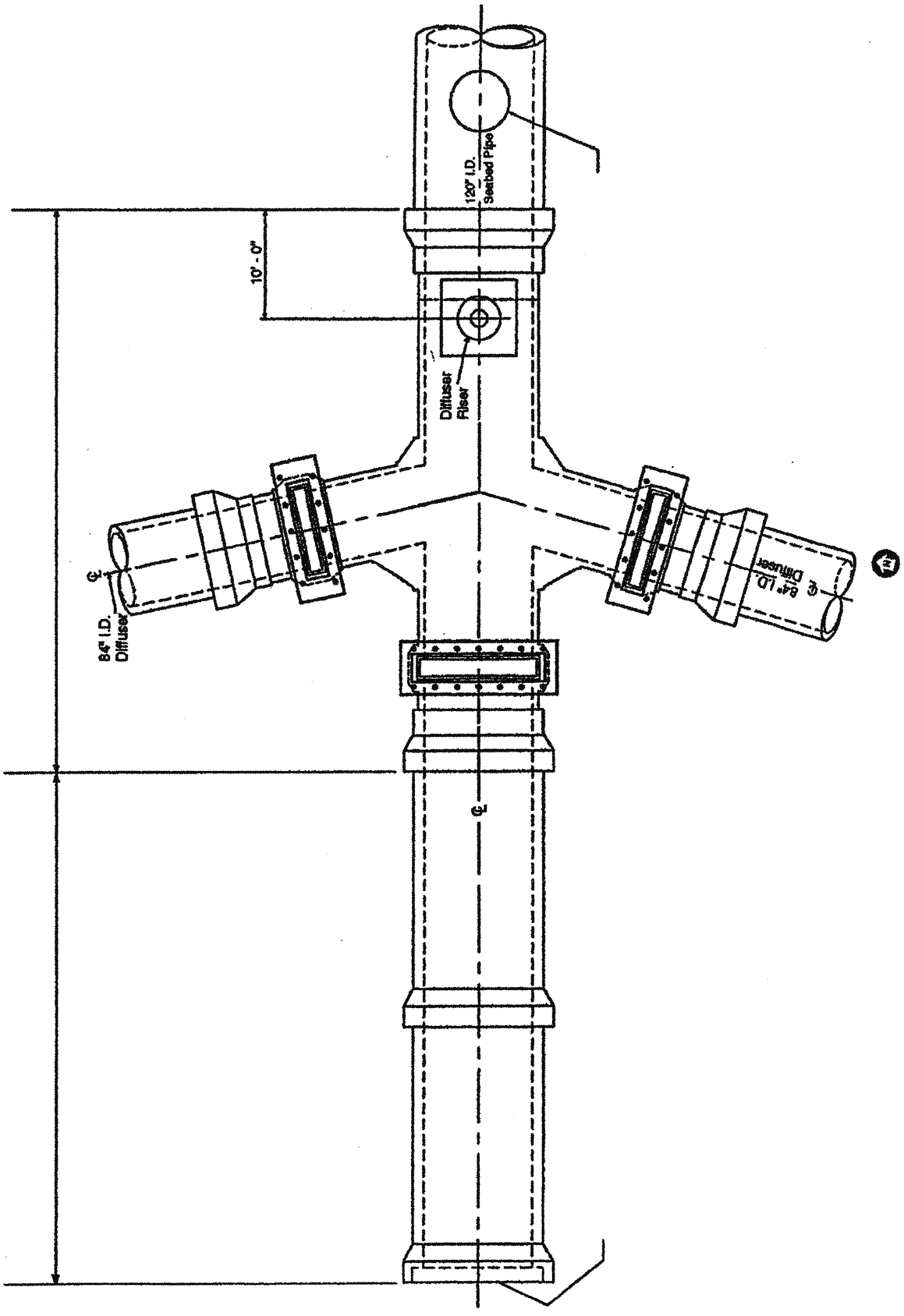


Figure 6. The diffuser wye structure for the South Bay Ocean Outfall.

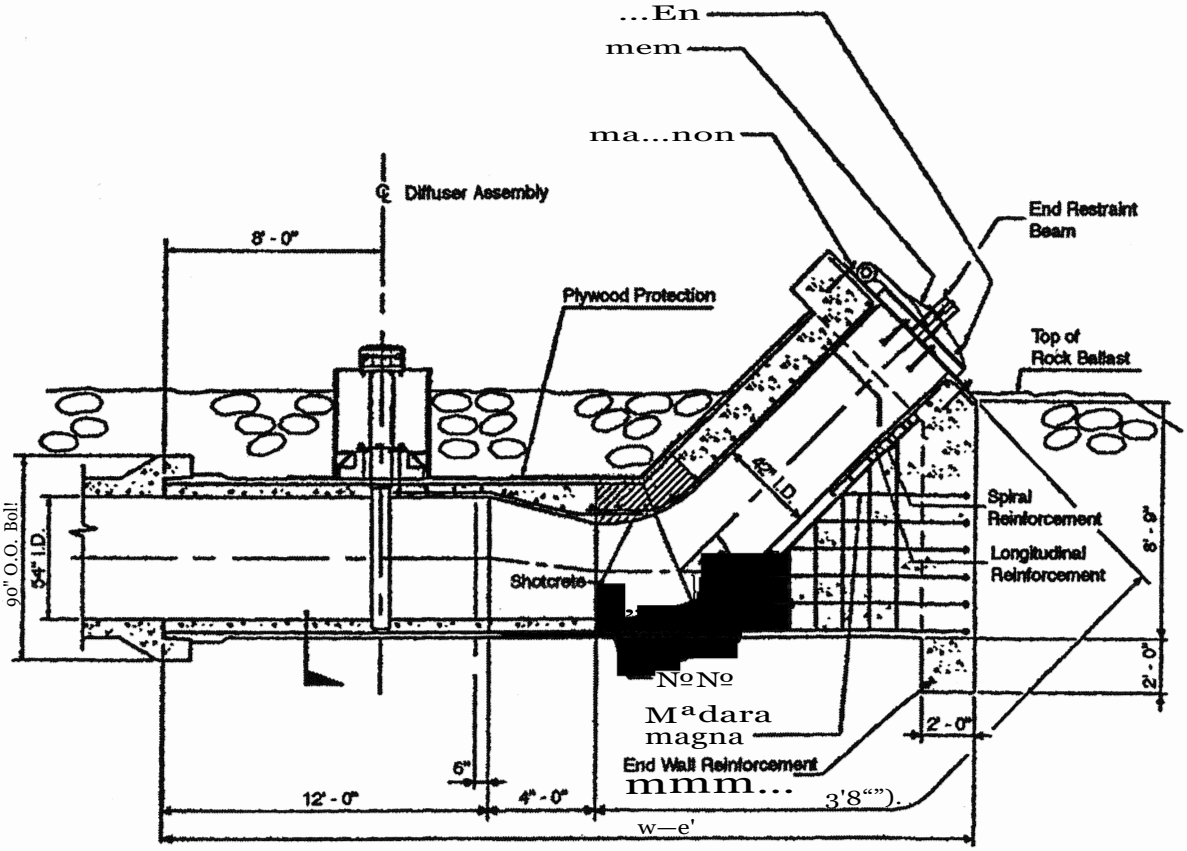


Figure 7. Termination structure found at the end of the South Bay Ocean Outfall diffuser legs.

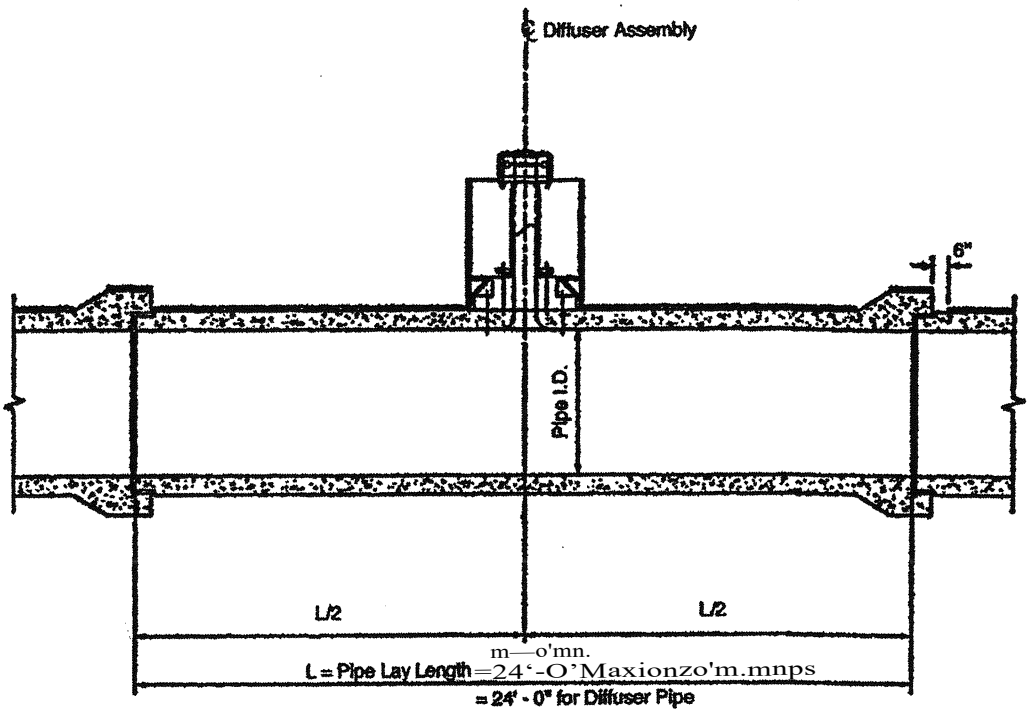


Figure 8. Diffuser assembly on the South Bay Ocean Outfall diffuser legs.

APPENDIX B

DIRECTORY OF SURVEY VIDEO FILES

File Name	Survey Date
City of San Diego 2012 SBOO ROV Inspection Video- 4.24-27.2012	
City of San Diego 2012 SBOO - South Diffuser Leg Part 1	4/24/2012
City of San Diego 2012 SBOO - South Diffuser Leg Part 2	4/24/2012
City of San Diego 2012 SBOO - South Diffuser Leg Part 3	4/24/2012
City of San Diego 2012 SBOO - Wye and North Diffuser Leg - Part 1	4/24/2012
City of San Diego 2012 SBOO - Wye and North Diffuser Leg - Part 2	4/24/2012
City of San Diego 2012 SBOO - Main Barrel - Part 1	4/27/2012
City of San Diego 2012 SBOO - Main Barrel - Part 2	4/27/2012
City of San Diego 2012 SBOO - Main Barrel - Part 3	4/27/2012
City of San Diego 2012 SBOO - Main Barrel - Part 4	4/27/2012
City of San Diego 2013/2014 SBOO ROV Inspection Video- 4.29.2014	
City of San Diego 2013/2014 SBOO - South Diffuser Leg	4/29/2014
City of San Diego 2013/2014 SBOO - Wye and Gate Covers	4/29/2014
City of San Diego 2013/2014 SBOO - North Diffuser Leg	4/29/2014
City of San Diego 2013/2014 SBOO - Main Barrel	4/29/2014
City of San Diego 2014 SBOO ROV Inspection Video- 9.23.2014	
City of San Diego 2014 SBOO - South Diffuser Leg	9/23/2014
City of San Diego 2014 SBOO - Wye and Gate Covers	9/23/2014
City of San Diego 2014 SBOO - North Diffuser Leg	9/23/2014
City of San Diego 2014 SBOO - Main Barrel	9/23/2014
City of San Diego 2015 SBOO ROV Inspection Video- 9.03.2015	
City of San Diego 2015 SBOO - South Diffuser Leg	9/03/2015
City of San Diego 2015 SBOO - Wye and Gate Covers	9/03/2015
City of San Diego 2015 SBOO - North Diffuser Leg	9/03/2015
City of San Diego 2015 SBOO - Main Barrel	9/03/2015
City of San Diego 2016 SBOO ROV Inspection Video- 9.08.2016	
City of San Diego 2016 SBOO Outfall Inspection - Complete	9/08/2016