NAPIER CITY COUNCIL

# NAPIER OUTFALL AND DIFFUSER INSPECTION REPORT 2016

# INCORPORATING FOLLOW UP INSPECTION

December 2016

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## 1.0 INTRODUCTION

OCEL Consultants New Zealand Limited (OCEL) have been engaged by the Napier City Council (NCC) to undertake an independent inspection of the Napier ocean outfall and diffuser to determine its current status. The inspection also satisfied the periodic inspection requirement of the Resource Consent conditions for the outfall earlier inspections having been undertaken by another diving contractor Greenfield Diving Services (GDS).

The inspection was undertaken in two separate operations an initial inspection on 6 and 7 September2016 and a subsequent inspection in the period 9-13 October 2016 taking advantage of the presence of the New Zealand Diving and Salvage (NZDS) workboat Island Leader in the area for work on the Hastings outfall diffuser.

The initial inspection was undertaken by a five man dive team from NZDS, accompanied by an OCEL engineer/diver F Teear, working from the NZDS 9 m long catamaran Squalus. Dive operations were conducted in fully sealed Viking contamination suits with sealed neck dams and KM 37 fully enclosed helmets with double exhaust valves.

The initial inspection found the pipeline and the diffuser to be either buried or the pipe crown was close to flush with the seabed. The end of the diffuser and approximately 40% of the diffuser length was found to be buried. The depth of burial at the end of the diffuser was unable to be confirmed by prodding alone. The diffuser ports with risers attached were found to be unprotected and discharging close to the seabed with variable flow rates.

To enable further inspection of the diffuser it was apparent that the diffuser needed to be exposed by dredging. The easiest and simplest way to do this is use an airlift. Airlifts are powered by compressed air from a high volume air compressor which requires the deck space and carrying capacity of a workboat in the 20 m length range.

The second phase of the inspection work was timed to coincide with the presence of the NZDS workboat Island Leader in Hawke Bay for inspection work on the Hastings outfall diffuser. Airlifting was undertaken to expose the top of the diffuser seaward from the end of the previous inspection where the top of the diffuser pipe was no longer flush with the seabed but submerged below it.

## 2.0 OUTFALL

The Napier outfall is located at Awatoto. The 3' (914.4 mm) ID (internal diameter) approximately 4' OD (1194 mm) submarine pipeline is of precast prestressed concrete construction and extends approximately 1.5 km offshore.

The diffuser section forms the end 120 m length of the outfall. The diffuser ports are located on top of the diffuser but the information supplied to OCEL was limited in detail and did not clearly specify the port/duckbill detail, total number of ports or the pipe connection detail. Drawing No S322/4 shows a cast iron diffuser port unit that is cast into the concrete outfall pipe - Figure No 1. How the existing risers are connected to this detail is not clear. The existing vertical risers inspected on the diffuser consisted of a tube welded to a square plate secured to the diffuser plate by 4 bolts. A duckbill was attached to the top of the riser. In some cases the top of the duckbill was either flush with or just below the seabed. Some of the risers were loose.

A review of previous inspection work carried out by GDS from 2012 to 2015 indicates approximately 40 – 45 ports are visible/in use. These inspections also indicate between 45 m and 50 m of the end section of the diffuser (~40%) is buried by up to 5 m of material at the offshore end. Drawing No S1124-5 shows that inshore of where the diffuser is shown as completely buried, the top of the pipe is generally within ± 0.05 m of the seabed level. The drawing also shows a kink or sharp change in angle in the pipe where it starts to descend to an estimated 5 m below seabed at the end. The kink could indicate a rupture in the pipe – however no rupture was apparent on the seabed at the descent point - but is more likely a simplistic representation – easier to draw than an elastic deflection curve.

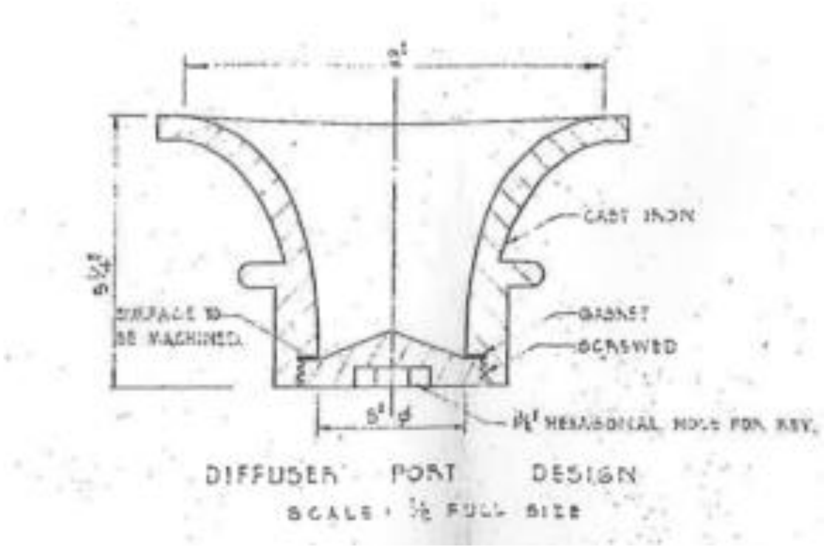


Figure No 1. Diffuser port detail from Drawing S322/4

## 3.0 SCOPE OF WORKS

The original scope of work was to undertake a:

- Condition assessment of the submarine pipeline.
- Condition assessment of diffuser ports, including checks for leaks and assess extent of sediment build-up.
- Investigate deflected profile of the buried end section of diffuser through water jetting.

Following an evaluation of the results of the initial inspection work a revised scope of work was decided on to complete the inspection of the diffuser.

- Locate and report condition of all (if possible) diffuser outlets.
- Excavate pipe as required to undertaken this task 0.5 m max.
- Locate depth to diffuser pipe air lance if more than 0.5 m to test theory that seaward end is deeply buried.
- Access ports as required to determine depth of sediment in pipe.
- Identify any significant structural or integrity issues if possible.
- Take video/photographs if conditions allow.
- Update report with new information.

## 4.0 INSPECTION

OCEL was supplied with GPS coordinates marking the inshore and offshore ends of the diffuser section – refer site plan DR-160502-001 Rev 1. The positions were loosely represented by yellow marker buoys. There were however no coordinates and an associated marker buoy at the inshore end of the outfall to mark the alignment of the pipeline.

### 4.1 Initial Inspection For The Initial Survey

For the initial inspection a diver was deployed at the inshore coordinate/yellow buoy to find the start of the diffuser pipe, however a circular search did not successfully locate the pipeline. Visibility was nil to 0.3 m. A white marker float labelled "Greenfield Diving Services" was evident along the diffuser alignment, which was found to be attached to a diffuser port. A line search approximately 3 m offshore of this position indicated increasing pipeline embedment to the point the where the pipe could no longer be located. An inshore search from this position covered approximately 35 m of pipeline over which 18 diffuser ports were encountered. The port spacing was not consistent, ranging from 1 m to 2 m and up to 3 m. Joints, or flanges were also encountered at irregular spacing along the pipeline, however the detail of these was inconclusive given the nil visibility. Divers noted the flanges were smooth and had no evidence of bolted connections. The condition of the ports/duckbills is summarised in DR-160502-001 Rev 1. Progress was significantly hampered due to difficulties in locating the pipeline. The top of the diffuser was either generally partially and fully buried between 20 mm to 300 mm, with a marginally higher build-up of material along the northern side of the pipeline relative to the southern side. Marine growth was evident across exposed regions of the pipe and at the base of the risers. Effectively zero visibility dive conditions precluded the use of video camera and meant the inspection was tactile, carried out by feel, and with a search line for the diver to orientate himself with the start position. Water jetting was carried out where the pipeline could not be located by other means which made for slow progress.

The risers were found to project vertically in the 12 o'clock position, or off vertical (11 o'clock) approximately 200 mm beyond the crown of the diffuser pipe, with the rubber duckbill adding another 250 mm. The diffuser ports were likely intended to discharge either side of pipe Top Dead Centre (TDC) but finished up at the 11 and 12 o'clock positions because of pipe rotation during installation. The base of the some risers appeared to have a bolted connection to the diffuser pipe – there was a degree of play observed to at least one of the connections. A number of ports did not have duckbills. Where there were duckbills, the connection detail to the riser did not appear to be consistent. This may be due to differing replacement risers/duckbills as part of historic maintenance. Leaks were evident at some connections which would not necessarily have been fixed through the simple process of tightening the clamp connection. A proportion of the risers were either partially buried or fully buried with just the duckbill evident above the seabed. Where the duckbills were missing the seabed level was effectively flush with some ports and pipe infilling is likely to have occurred. A crowbar was used to check for obstructions within the duckbills/ports and provide an approximately gauge on the level of infill. Flow was either constant, partial, or not evident. In some cases the flow could be improved by partial clearing of obstructions with the crow bar. Although the crow bar was not long enough to offer a measureable gauge of material build-up within the diffuser pipe, indications are that restrictions in flow along a number of ports reflect a reduction in operation effectiveness of the diffuser.

The inspected length equated to less than one third of the total diffuser length, with approximately 40% of the pipe buried offshore of the white marker float. That leaves approximately another 35 m of diffuser pipe and associated ports to be inspected. Inspection of the remaining inshore diffuser section and water jet profiling offshore of the white marker float could not be completed within the weather/sea state window due to strong offshore winds and increasing swell wave heights, with the team demobilising upon return to shore. The outfall pipeline could not be inspected independently of the diffuser section without an accurate coordinate or reference point, and would have followed on from the inshore progression from the diffuser inspection. The pipeline inshore of the diffuser is either buried or close to buried and would either need to be exposed by dredging to enable external inspection or an intelligent pig or sonar device run internally.

### 4.2 Second Inspection

For the second inspection phase using Island Leader, and an airlift to expose the diffuser where it was buried, the inspection started at the inshore end of the diffuser and proceeded offshore. An airlift is a simple excavation tool with no moving parts. Compressed air is injected close to the suction intake of the airlift pipe. As the introduced air mixes with water inside the pipe, as the air ascends it creates an air water mixture less dense than the surrounding seawater outside the pipe. The less dense fluid/air mixture is displaced up the pipe by higher density seawater entering the bottom of the tube. Solids are entrained with the water drawn in at the bottom and ejected out the discharge hose at the top. The deeper the water and the longer the pipe, the higher the pressure differential between entry and exit, the better the suction. The depth at the NCC diffuser location, 10 – 11 m will result in an efficient operation.

The results of the inspection are shown in Table No 1. The distance between diffuser ports and diffuser features was measured by the inspection diver in zero visibility conditions so the measurements are approximate. The cumulative distance provided based on the spacing measurements is also approximate. Airlifting was undertaken to the point where the pipe crown was buried in excess of 0.5 m below the seabed. Thereafter an air lance was used to determine depth of burial.

Based on the cumulative distance the inspection covered close to the full length of the diffuser although the end of the diffuser was not positively identified by the air lance. The depth of burial recorded however was close to 1.8 m, not the 5 m shown on the NCC drawings.

## 5.0 EVALUATION OF THE RESULTS

The top of the pipeline and the diffuser section is close to flush with the seabed alternating between burial and exposure of the pipe crown for approximately the first 30m of the diffuser, the part covered by the initial inspection. Thereafter the seabed cover varies from 150 to 300 mm before the end of the diffuser starts its descent into the seabed at approximately 45 m from the offshore end of the diffuser.

The end of the diffuser is shown as 5 m below seabed on the NCC drawing. This is high for the elastic deflection of a prestressed concrete pipe 914.4 mm ID over 45 m and suggests, if true, that the pipe has cracked or ruptured at that point. The drawing shows an abrupt kink at that point but it is more likely a simplistic representation of the start of the descent. Easier to draw a straight than the quadratic curve form of the elastically deflected shape. The maximum depth obtained using an air lance close to the end of the diffuser, 1.8m is more consistent and achievable with an elastically deflected pipe.

The condition of the diffuser ports uncovered in the second phase of the inspection was the same as for the first phase and the conclusions reached are the same.

## 6.0 WAY FORWARD

The diffuser will not be operating as designed, the dilution levels will be much less than intended or consented because of the reduced length of diffuser at seabed level, blocked ports and infilling. The current situation has been the case for several years, regular inspections merely record which diffuser ports are operating or blocked. The diffuser ports need to be fitted with risers to allow the ports to discharge clear of the seabed. Because the diffuser is unprotected the diffuser risers will need to be protected by an overtrawl structure as illustrated in Sketch No 1. OCEL understands that the maintenance diving contractor GDS has found nets snagged on the diffuser in the past. Previously during inspection work on the Hastings District Council (HDC) outfall OCEL noted the presence of trawlers operating around both the HDC and NCC outfall diffusers. Although exclusion zones are in place, the provision overtrawl protection for the diffuser riser ports would be prudent given the ports are relatively small diameter and need to be extended to clear the seabed.

The depth indicated by the air lancing to the end of the pipe puts the end flange in the accessible range using a caisson structure to enclose the end of the diffuser pipe and allow access. The caisson would be installed by jetting over the end of the pipe and excavated internally to remove seabed sediment from the inside exposing the end pipe flange and allowing divers to descend inside the caisson. NZDS have an existing 3.2 m diameter aluminium casing used for a similar purpose to access a flange on the Waimakariri District outfall. Having accessed the blind flange on the end the blind flange can be removed and the diffuser pipe flushed.

To enable the diffuser ports to be operated either risers would need to be fitted to the ports to reach the seabed or the pipe could be lifted and supported on piles. Either solution would involve extensive subsea work and it may be better to consider cutting the diffuser pipe off where it descends into the seabed and fitting a tee piece to the end of the outfall to allow the installation of a new replacement diffuser length supported on screw piles. Prior to this an assessment of the pipeline internal condition would be required.

## 7.0 CONDITION ASSESSMENT

Having gained access to the interior of the pipeline via the end flange a RedZone Robotics HD sonar sub can be used to undertake an assessment of the pipeline. A sonar sub device has been used for a condition assessment of the Gisborne outfall. The device is neutrally buoyant and is equipped with sonar to capture data underwater. An onboard battery power and logging make it autonomous.

It could be run up the diffuser from the offshore end using a battery powered underwater scooter to tow the device, restrained by the rope from the flange end which would be used to pull it out backwards, assisted by the outfall flow. Given the internal diameter of the pipe a diver could travel up the pipeline up to 200 m from the offshore end. NZDS have previously done this on the WDC outfall, provided there are no obstructions. The sonar tool would be run first to identify sediment infill and any major structural problems with the pipe interior. With the end flange off an attempt could be made to flush out any infill by running the onshore pumps at maximum discharge. If this was unsuccessful then a diver could be used to operate a water eductor dredging tool – powered by high pressure water – to remove the infill. Having cleared the infill the diver could then check the pipe interior. This would have to be done during short shutdown periods.

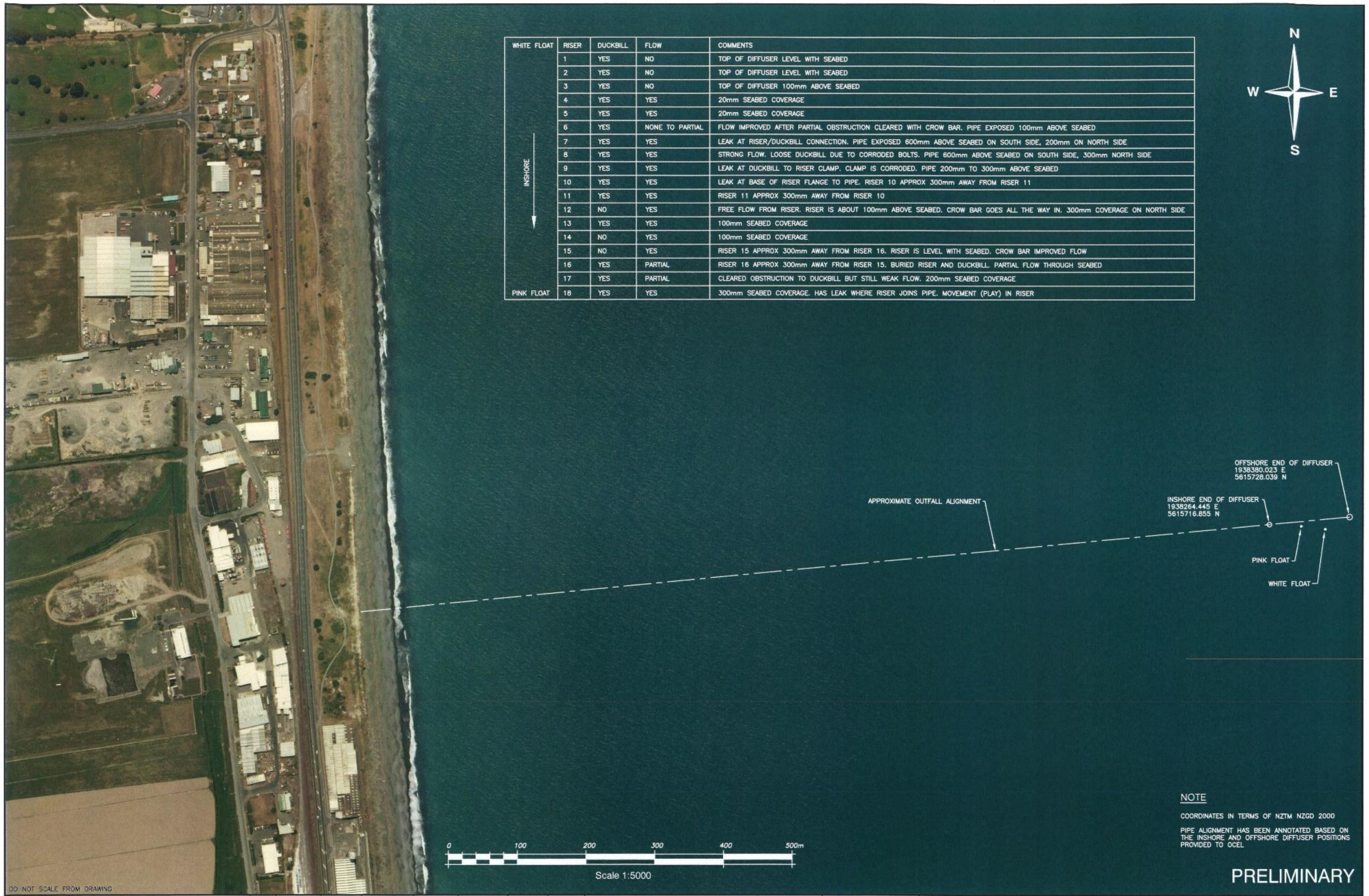
## 8.0 CONCLUSIONS

The pipeline and diffuser were found to be either buried or the pipeline crown was close to flush with the seabed. The end of the diffuser, approximately 40% of the diffuser length, was found to be buried but not as deep as the 5 m figure indicated on the NCC drawing. While the end was not positively located using an air lance probing close to the end indicated a depth of burial closer to 1.8 m making it accessible using a cylindrical caisson installed over the pipe end. Once the end of the pipe can be accessed and the blind flange removed the outfall can be flushed, and internal inspection tools such as the RedZone Robotics HD Sonar profiler run to obtain a condition assessment. Diver inspection can be undertaken inside the pipe up to 200 m from the offshore end once obstructions are cleared. The HD sonar can be run over the entire outfall length.

The diffuser ports with risers attached were found to be unprotected and discharging close to the seabed with variable flow rates, low rates indicating obstruction. Duckbills were missing and infill had occurred in the diffuser pipe. The existing situation is unsatisfactory and not achieving the required dilution standards. Intervention is required to refurbish the diffuser, establish consistent flow rates across ports and clear obstructions and internal infill.

The diffuser needs to be fully exposed by dredging using an airlift, and new risers fitted protected by an overtrawl structure.

An engineering study is required to determine if the end of the diffuser can be lifted – this will be determined in part by the results of an internal assessment of the diffuser pipe – or whether the end buried in the seabed is cut off and a pipe tee fitted on the inshore side of the cut to allow new riser arms to be fitted.




| WHITE FLOAT | RISER | DUCKBILL | FLOW | COMMENTS |
|---|---|---|---|---|
| | 1 | YES | NO | TOP OF DIFFUSER LEVEL WITH SEABED |
| | 2 | YES | NO | TOP OF DIFFUSER LEVEL WITH SEABED |
| | 3 | YES | NO | TOP OF DIFFUSER 100mm ABOVE SEABED |
| | 4 | YES | YES | 20mm SEABED COVERAGE |
| | 5 | YES | YES | 20mm SEABED COVERAGE |
| | 6 | YES | NONE TO PARTIAL | FLOW IMPROVED AFTER PARTIAL OBSTRUCTION CLEARED WITH CROW BAR. PIPE EXPOSED 100mm ABOVE SEABED |
| | 7 | YES | YES | LEAK AT RISER/DUCKBILL CONNECTION. PIPE EXPOSED 600mm ABOVE SEABED ON SOUTH SIDE, 200mm ON NORTH SIDE |
| | 8 | YES | YES | STRONG FLOW. LOOSE DUCKBILL DUE TO CORRODED BOLTS. PIPE 600mm ABOVE SEABED ON SOUTH SIDE, 300mm NORTH SIDE |
| INSHORE | 9 | YES | YES | LEAK AT DUCKBILL TO RISER CLAMP. CLAMP IS CORRODED. PIPE 200mm TO 300mm ABOVE SEABED |
| | 10 | YES | YES | LEAK AT BASE OF RISER FLANGE TO PIPE. RISER 10 APPROX 300mm AWAY FROM RISER 11 |
| | 11 | YES | YES | RISER 11 APPROX 300mm AWAY FROM RISER 10 |
| | 12 | NO | YES | FREE FLOW FROM RISER. RISER IS ABOUT 100mm ABOVE SEABED. CROW BAR GOES ALL THE WAY IN. 300mm COVERAGE ON NORTH SIDE |
| | 13 | YES | YES | 100mm SEABED COVERAGE |
| | 14 | NO | YES | 100mm SEABED COVERAGE |
| | 15 | NO | YES | RISER 15 APPROX 300mm AWAY FROM RISER 16. RISER IS LEVEL WITH SEABED. CROW BAR IMPROVED FLOW |
| | 16 | YES | PARTIAL | RISER 16 APPROX 300mm AWAY FROM RISER 15. BURIED RISER AND DUCKBILL. PARTIAL FLOW THROUGH SEABED |
| | 17 | YES | PARTIAL | CLEARED OBSTRUCTION TO DUCKBILL BUT STILL WEAK FLOW. 200mm SEABED COVERAGE |
| PINK FLOAT | 18 | YES | YES | 300mm SEABED COVERAGE. HAS LEAK WHERE RISER JOINS PIPE. MOVEMENT (PLAY) IN RISER |

NOTE

COORDINATES IN TERMS OF NZTM NZGD 2000

PIPE ALIGNMENT HAS BEEN ANNOTATED BASED ON THE INSHORE AND OFFSHORE DIFFUSER POSITIONS PROVIDED TO OCEL

| Amendments | Rev'n | Date | Drawn | Issued for | Checked | Approved |
|---|---|---|---|---|---|---|
| PRELIMINARY | 1 | 09/11/16 | FT | PRELIMINARY | | |

Drawn: FT
Checked:
Traced:
Approved:
Date: 09/16

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NAPIER CITY COUNCIL
OUTFALL AND DIFFUSER INSPECTION 2016
SITE PLAN

Scale (A3): AS SHOWN
ACAD Filename: 160502/DR-160502-001R1
Drawing No.: DR-160502-001
Rev.: 1

**TABLE No 1**

# NAPIER OUTFALL (DIFFUSER SECTION 20 m)

| Diffuser # | Spacing | Cumulative Distance | Diffuser Height | Natural S/B above Crown | Orientation | Probe Dpths | Additional Info |
|---|---|---|---|---|---|---|---|
| #1 | | | 300mm | Level with crown | 12 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present. (C) MARKER FLOAT INSTALLED |
| #2 | 2mtr | 2 | 300mm | 50mm | 12 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present. (S) |
| #3 | 2mtr | 4 | 300mm | 50mm | 11 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present (C) |
| #4 | | 6 | 150mm | 50mm | 11 O'clock | 1.3mtrs (Nil Sed) | Steady flow, No DB (C) |
| #5 | 1mtr | 7 | 150mm | 50mm | 2 O'clock | No probe | Steady flow, No DB (S) |
| #6 | | 8 | 300mm | 50mm | 2 O'Clock | No probe | Steady flow, DB present (C) |
| Gasket (Join) | 3mtr | 11 | - | 100mm | - | - | - |
| Gasket (Join) | 2mtr | 13 | - | 100mm | - | - | - |
| #7 | .5mtr | 13.5 | 300mm | 100mm | 12 O'clock | 1.6mtr (Nil Sed) | Steady flow DB Present (S) |
| Gasket (Join) | 2mtr | 15.5 | - | 100mm | - | - | - |
| Gasket (Join) | 3mtr | 18.5 | - | 50mm | - | - | - |
| #8 | 2mtr | 20.5 | 300mm | Level with Crown | 11 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present (C) |
| #9 | | 22.5 | 300mm | Level with Crown | 11 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present (S) |
| Gasket | 1.5 | 24 | | Level with Crown | - | - | - |
| #10 | .5mtr | 24.5 | 150mm | Level with Crown | 2 O'clock | No Probe | Steady flow, No DB, (S) |
| #11 | 1mtr | 25.5 | 150mm | Level with Crown | 11 O'clock | 1.3mtrs (Nil Sed) | Steady flow, Mussel coverage cleared, No DB (C) |
| Gasket | .5mtr | 26 | | Level with Crown | - | - | - |
| #12 | .5mtr | 26.5 | 300mm | Level with Crown | 11 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present (C) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **#13** | 1mtr | 27.5 | 300mm | Level with Crown | 2 O'clock | 1.6mtrs (Nil Sed) | Steady flow, Layflat hose used for DB (C) |
| **Gasket** | 1mtr | 28.5 | - | - | - | - | - |
| **Gasket** | 2mtr | 30.5 | - | - | - | - | - |
| **#14** | 1.5mtr | 32 | 300mm | 200mm | 12 O'clock | 1.5mtrs (50mm Sed) | |
| **#15** | 1mtr | 33 | 300mm | 200mm | 12 O'clock | (100mm Sed) | Mild flow, DB present (Muscle growth cleared.) |
| **#16** | | | 300mm | 200mm | 12 O'clock | (100mm Sed) | Mild flow, DB present (Muscle growth cleared.) |
| **#17** | 2mtr | 35 | 300mm | 200mm | 12 O'clock | (50mm Sed) | Steady flow, DB present. (S) x2 Nuts missing from bolts. |
| **#18** | 3mtr | 38 | 300mm | 100mm | 12 O'clock | 1.6mtrs (Nil Sed) | Steady flow, DB present |
| **Gasket** | 1mtr | 39 | - | 50mm | - | - | - |
| **#19** | 1mtr | 40 | 150mm | Level with Crown | 11 O'clock | 1.6mtrs (Nil Sed) | Steady flow, No DB |
| **Gasket** | 1mtr | 41 | - | 50mm | - | - | - |
| **#20** | 2mtr | 42 | 150mm | 200mm | 2 O'clock | Approx (50mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **#21** | 1.5mtr | 43.5 | 300mm | 150mm | 12 O'clock | Approx (50mm Sed) | Blocked Diffuser, DB present, heavy muscles growth, (cleared-steady flow) |
| **#22** | 2mtr | 45.5 | 150mm | 200mm | 11 O'clock | Approx (50mm Sed) | Blocked Diffuser, DB present, heavy muscles growth, (cleared-steady flow) |
| **#23** | 1mtr | 46.5 | 150mm | 150mm | 11 O'clock | Approx (75mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **#24** | 2mtr | 48.5 | 150mm | 100mm | 12 O'clock | Approx (75mm Sed) | Steady flow, No DB |
| **#25** | 1.5mtr | 50 | 300mm | 200mm | 12 O'clock | Approx (75mm Sed) | Blocked Diffuser, DB present, heavy muscles growth, (cleared-steady flow) |
| **#26** | 2mtr | 52 | 300mm | 300mm | 12 O'clock | Approx (75mm Sed) | Blocked Diffuser, DB present, heavy muscles growth, (cleared-steady flow) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gasket** | 1.5mtr | 53.5 | - | - | - | - | - |
| **#27** | 1.5mtr | 55 | 150mm | 200mm | 12 O'clock | Approx (100mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **Gasket** | 1mtr | 56 | - | - | - | - | - |
| **Gasket** | 1mtr | 57 | - | - | - | - | - |
| **#28** | 1mtr | 58 | 150mm | 100mm | 12 O'clock | Approx (100mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **#29** | 2mtr | 60 | 300mm | 150mm | 11 O'clock | Approx (100mm Sed) | Blocked Diffuser, DB Present, heavy muscles growth, (cleared-steady flow) |
| **#30** | | 62 | 300mm | 150mm | 12 O'clock | Approx (100mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **#31** | 2mtr | 64 | 300mm | 150mm | 12 O'clock | Approx (250mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **Gasket** | 1.5mtr | 65.5 | - | - | - | - | - |
| **#32** | 1mtr | 66.5 | 150mm | 200mm | 1 O'clock | Approx (500mm Sed) | Blocked Diffuser, No DB, heavy muscles growth, (cleared-steady flow) |
| **#33** | 1mtr | 67.5 | 300mm | 100mm | 12 O'clock | Approx (500mm Sed) | DB Present, heavy muscles growth, (cleared-flow incresed) (C) |
| **#34** | 1mtr | 68.5 | 300mm | Level with Crown | 1 O'clock | Approx (1mtr Sed) | DB Present, heavy muscles growth, (cleared-flow incresed) |
| **Gasket** | 1mtr | 69.5 | - | - | - | - | - |
| **#35** | 1mtr | 70.5 | 150mm | Level with Crown | 12 O'clock | Approx (1.3mtr Sed) | Weak flow, No DB |
| **#36** | 1mtr | 71.5 | 150mm | Level with Crown | 12 O'clock | Approx (1.4mtr Sed) | Weak flow, No DB |
| **#37** | 1.5mtr | 73 | 150mm | Level with Crown | 1 O'clock | Pipe Full of Sed | No flow, No DB |
| **#38** | 1mtr | 74 | 300mm | Level with Crown | 12 O'clock | Pipe Full of Sed | No flow, DB Present(C) |
| **#39** | 2mtr | 76 | 300mm | Level with Crown | 10 O'clock | Pipe Full of Sed | No flow, DB Present (S) |
| **#40** | 1.5mtr | 77.5 | 150mm | Level with Crown | 11 O'clock | Pipe Full of Sed | No flow, No DB (S) |
| **Gasket** | 1.5mtr | 79 | | 50mm | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **#41** | 1.5mtr | 80.5 | - | 50mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | .5mrt | 81 | - | 100mm | - | - | - |
| **#42** | 1.5mtr | 82.5 | - | 100mm | 2 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | .5mtr | 83 | - | 100mm | - | - | - |
| **#43** | 1mtr | 84 | - | 100mm | 2 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | .5mtr | 84.5 | - | 100mm | - | - | - |
| **#44** | 1mtr | 52.5 | - | 150mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **#45** | .5mtr | 86 | - | 200mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 1mtr | 87 | - | - | - | - | - |
| **#46** | .5mtr | 87.5 | - | 300mm | 2 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 1.5mtr | 89 | - | - | - | - | - |
| **#47** | 1mtr | 90 | - | 300mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 2mtr | 92 | - | - | - | - | - |
| **#48** | 3mtr | 95 | - | 300mm | 2 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 2mtr | 97 | - | - | - | - | -\ |
| **#49** | 1mtr | 98 | - | 350mm | 2 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 2mtr | 100 | - | - | - | - | - |
| **#50** | 1.5mtr | 101.5 | | 350mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **#51** | 1mtr | 102.5 | - | 350mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **#52** | .5mtr | | - | 350mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | .5mtr | 103 | - | - | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **#53** | 1.5mtr | 104.5 | - | 400mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | .5mtr | 105 | - | - | - | - | - |
| **#54** | .5mtr | 105.5 | - | 450mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Gasket** | 1.5mtr | 107 | - | - | - | - | - |
| **#55** | .5mtr | 107.5 | - | 450mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **#56** | 1mtr | 108.5 | - | 500mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **#57** | 1.5mtr | 110 | - | 500mm | 11 O'clock | Pipe Full of Sed | No Riser or DB (120mm Diffuser port hole) |
| **Exceeded 500mm of natural seabed coverage (Continue Air Lance/Lifting)** | | | | | | | |
| **Gasket** | .5mtr | 110.5 | - | 550mm | - | - | - |
| | 1.5mtr | 112 | - | 550mm | - | - | - |
| | 1mtr | 113 | - | 700mm | - | - | - |
| **Gasket** | 1mtr | | - | 900mm | - | - | Gasket noted protruding inside concrete pipe by 40mm, (3mtr Subsea marker float installed) |
| | 1mtr | 114 | - | 1mtr | - | - | - |
| | 1mtr | 115 | - | 1.2mtr | - | - | - |
| | 1mtr | 116 | - | 1.2mtr | - | - | Located lifting eye @ 12 O'clock position with a length of chain extending to the North side of pipe into seabed. (MARKER FLOAT INSTALLED) |
| **Gasket** | .5mtr | 116.5 | - | 1.3mtr | - | - | - |
| | 2mtr | 118.5 | - | 1.4mtr | - | - | - |
| | 2mtr | 120.5 | - | 1.6mtr | - | - | - |
| | 2mtr | 122.5 | - | 1.8mtr | - | - | - |

## Additional Information:

Start of Diffuser POS: 39'32.4963s / 176'56.1717e

Damaged pipe POS: 39'32.4963s / 176'56.1990e

Pipe Lifting eye POS: 39'32.4868 / 176'56.2314e

(Close to offshore End of pipe)

## KEY:

- (S) Stud fixture to diffuser ports.
- (C) Camlock fixture to diffuser ports.
- (Highlighted) Off importance.