



**Table A Cost Estimate for TDBC Diffuser Upgrade/Repair Options**

Activity/Material	Estimated Cost
Option 1 – Removal and Replacement of Similar Diffuser Design	\$298,500
Option 2 – Removal and Replacement of Diffuser with New Design	\$296,900
Option 3 – Abandonment and Replacement of Diffuser with New Design	\$334,000
Option 4 – Repair/ Removal and Replacement of the 10 and 6 in HDPE spools	\$183,000

## 10. Conclusions and Recommendation

### 10.1 Conclusions

Based on the results of this assessment, the following conclusions were made:

- Sections of the diffuser appear to be damage, either partially operating (downstream end of the 10-in. segment) or non-operating (6 in. segment). Based on the 2017 underwater survey prepared by Bishop Diving & Salvage, the 6-in. segment of the diffuser is non-operational with no flow observed in any of its ports. Also, per the underwater survey the 10-in. segment appears to have weak flow at the downstream end. The CCTV camera inspection completed by Subtronic Corporation indicated that a blockage was present at the downstream end of 10 in. segment, verifying the flow observations made by the underwater survey.
- The hydraulic assessment completed for the TDBC sanitary system (from the lift station to the outfall) indicated that the current system is operating with higher head loss compared to its original design. Therefore, the lift station has to deliver a higher pumping head to convey flow through the system. The results showed that to deliver a flow of 3.11 MGD the lift station required a pumping head of 19.9 psi, while under normal conditions the expected pumping head should be of approximately 15 psi. The higher-pressure head required is a result of additional losses encountered by flow being channeled through a lower number of diffusers which increases the jet velocity and the loss at each Tideflex valve. These increased head losses are in agreement with 2017 results of the underwater and the CCTV camera inspection.
- To improve the overall system performance, the existing diffuser should be repaired or upgraded. To this point four repair /upgrade options have been prepared as described in Section 6.



## 10.2 Recommendations

- Based on the results of this assessment, the following recommendations were made:
- To verify that there are no significant issues with the performance of the Lift Station (5 pumps), it is recommended to complete a pumping test using the lift station recirculation system. The result of this pump test should be then compared to the original performance result of the system to confirm no loss in original pumping performance.
- To assist the outfall repair/upgrade design, a bathymetric survey of the outfall area is recommended. This survey will provide details of the river bed, and indicate if scour or sedimentation has occurred near the outfall area and inform the bed preparation design for the selected option.
- The probability distribution of mean river velocity indicates that scour is an important criterion that must be considered in the riverbed diffuser support design. Therefore, it is recommended that for Options 1, 2, and 4 the diffuser be placed in an excavated trench below the depth of scour, approximately 2.5 feet below the existing riverbed, and for all four options, an articulated concrete block matt (ACBM) should be installed above the header at the level of the existing bed to prevent scour in the region of the diffuser. Since the ACBM is porous, it would be important to incorporate a geotextile into the design to prevent bed material loss through the interstitial spaces.
- Out of the four repair/upgrades presented in this document, WorleyParsons recommends Option 3, as it will require less disturbance of the outfall area and may require an easier installation. This option will also use reduced number of ports, which will reduce maintenance and lower the chances of obstruction damage. In addition, this option will involve shorter ports compared to the original design therefore, allowing for sufficient water depth above it without restricting boating activities in the river.
- It is recommended that for all design options a protection (e.g. metal cage) be considered to prevent damage from boating activities (e.g. vessel anchors).
- As part of the construction activities and per the State of California requirements it is recommended to implement a turbidity monitoring program for the duration of the construction activities.
- It is recommended to develop and implement a periodic (e.g. annual) maintenance plan to repair any damages, prevent failure and reduce the need for extensive future repairs.
- As part of the upgrade/repair options WorleyParsons recommends installing valves equipped with pneumatic actuator for both the diffuser ports and the downstream end of it. A 6-in. return line could be installed for discharge onshore.
- It is important to note that for all these options the diffuser will be out of commission while replacement is completed. Alternative discharge options should be considered for treated effluent including its regulatory implications.