



# Pipeline Routing Memo

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A handwritten signature in black ink, appearing to read 'E. Cotter', is positioned above a horizontal line.

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## Introduction

The intake and discharge pipeline for Nordic Aquafarms proposed land based Recirculating Aquaculture System (RAS) facility in Belfast, Maine consists of two, 30" HDPE intake pipes, and a single 36" outfall pipe. Both the intake and discharge pipelines originate at the Water Treatment Plant (WTP) immediately to the West of Rt 1 on the project site and extend eastward out into Penobscot Bay. The pipelines are completely buried in the upland, intertidal, and a portion of the subtidal sections and transition to above the seafloor at a water depth of approximately 40' below Mean High Water (MHW). Once the pipes are exposed, they will be elevated above the seafloor using a system of concrete anchors until the respective discharge and intake points are reached. An overall plan and profile view of the pipeline is provided in drawing CS101 (**Appendix A**)

The purpose of this document is to present the reasoning behind the selected path of the intake/discharge pipeline, and to provide a more detailed description of its layout and design.

## Path Selection and Location

As shown in **Appendix A**, the buried pipe transitions across the intertidal to submerged land taking as straight a course as possible eastward toward the discharge and intake points. This segment is buried under-- not built or placed upon--submerged lands and thus exempt from setbacks without an alternatives analysis. The discharge and intake points were carefully coordinated to provide favorable and complementary depth, current, distance, and ocean bottom conditions to support construction and avoid interference between the intake and outfall as discussed in detail in **Appendix B**. Shifting the course further to the South would require hundreds more feet of piping (a minimum of 160' per line). This increase in length before the bend toward the discharge location would decrease the radius of the bend (i.e. make sharper) by several hundred feet. Pipeline construction, operation, and maintenance becomes more and more difficult and costly with every deviation from a straight line. Construction is more complicated because the curved pieces are more difficult to fabricate, handle in construction, and properly join. Operations are more complicated because sharper curvature of the pipeline makes regular cleaning much more challenging and technically complicated. It should also be noted that the presented pipeline features this bend beyond the intertidal in order to avoid crossing the Northport town line until further offshore. Furthermore, increased length may require changes to pipe bore and/or pump size in order to accommodate the pressure head losses and ensure water supply that meets project needs. In short, increasing the length and curvature of the piping is not a reasonable alternative, as discussed in more detail in the attached alternatives analysis for the Maine Department of Environmental Protection with regard to discussion of the southern route (a pipeline route previously proposed to the Bureau, See **Appendix C** at pgs. 19-21 (southern route)). Construction impacts to coastal wetlands with such a steeply curved route would increase by an estimated 77% (62,000 sq. ft.) and the increased length would impose additional impacts on the ocean environment and benthic communities. It should be noted that the benthic studies and video analysis Nordic conducted documented greater biodiversity and abundance nearer to the outlet of the Little River. Curving the pipeline route further to the south would be expected to pose additional impacts not only because of the increased length, but also because of the differences in the substrate in the excavation area. Finally, the cost of a steeply curved route would increase significantly.

## Pipeline Description

The following section discusses the major sections of the pipeline, with an accompanying graphical view presented in **Appendix D**.

### **Upland Section – Stations 0-500**

In this section, both the intake and discharge pipes are completely buried, extending from the WTP, beneath Rt 1, and to the MHW line delineating the intertidal zone. The intake pump station of the WTP sits at a much lower elevation than the discharge lines, and therefore the two intake lines sit a significantly greater depth in the upland portion. The buried elevations of the intake and discharge lines roughly converge as they approach the intertidal zone at a top-of-pipe depth of about 5 feet below the surface.

### **Intertidal Section – Stations 500-1350**

As noted in the previous section, the pipes will be buried throughout the intertidal zone. **Detail 1 of Appendix E** shows an example cross section of the pipes in this region. It should be noted that while the area immediately around the pipes will be filled with crushed stone for stabilization, the pipes themselves will be buried beneath at least 5 feet of natural sediments, replaced and restored following the excavation and pipeline installation processes.

### **Submerged and Buried Section – Stations 1350-3200**

Once the buried pipes transition from the intertidal to the subtidal region, they will begin to gradually bend eastward towards the intake and discharge points. The pipes will remain buried using the same method as in the intertidal (**Detail 1 of Appendix E**) and will only begin to emerge from the seafloor approximately 1,850 feet into the subtidal region at a depth of about 40' below MHW.

### **Transition to Exposed – Stations 3200-3600**

Here the pipes begin to transition from buried to exposed gradually. As the amount of natural cover over the pipes diminishes an anchoring system will be put in place to secure the pipelines as they emerge. A cross-section of this is presented in **Detail 2 of Appendix E**. The total length of this transition section is approximately 400 feet, after which the pipes will be elevated slightly above the seafloor by concrete anchors which counteract the buoyancy of the pipes and hold them in place along the seafloor.

### **Exposed to Discharge – Stations 3600-4200**

The exposed pipelines will proceed above the seafloor, secured approximately every 15 feet by a concrete collar, each of which will feature an anchoring system to keep it stable and in place. **Detail 3 of Appendix E** shows an example of this configuration, along with the possible anchoring methods. A

combination of helical and guide post anchors is expected to be used dependent on which matches the sediments encountered at each specific anchor location. The discharge line will terminate in this section with a 3-port diffuser (**Detail 7 of Appendix F**) at a water depth of about 47 feet below MHW, while the intake lines will continue further out into the bay.

#### **Exposed to Intake – Stations 4200 – 6925**

The two intake lines proceed to the intake point using a similar anchoring system as before, though the concrete collars are now smaller due to there only being two pipes (**Detail 4 of Appendix E**). The two intake lines terminate approximately 6,190 feet into the bay from where they cross the MHW line, but the intake structures (**Detail 6 of Appendix F**) themselves are slightly staggered. The two intake lines terminate at a depth of about 58 feet below MHW, however the intake points themselves are raised approximately 8' above the pipes.

**Appendix A:**  
**Drawing CS101**

**Appendix B:**  
**Effluent Analysis**

**Appendix C:**  
**Alternatives Analysis**

**Appendix D:**  
**Pipeline Sections**



**Appendix E:**  
**Drawing CS501**

**Appendix F:**  
**Drawing CS502**