Chapter 4

Nursery: facilities and culture of post-larvae

4.1 NURSERY FACILITIES

Two methods of settling larvae are used at the model hatchery/nursery in Bermuda. The first involves the setting of pediveligers on a downwelling system of sieves in a raceway and continued rearing fixed spat until they reach at least 2 mm in shell height;

spat may be kept in this system until they reach 5–10 mm shell height. This method requires continuous monitoring in the nursery and is labour intensive; nonetheless, it maximizes survival of spat to the juvenile stage. The second system, involves the setting of larvae on cultch (or artificial substrate) submerged in a circular tank for a shorter rearing time until spat reach 1 mm shell height. In this latter system, spat are transferred to the natural environment on a suspended culture system of longlines within one month of settlement. This method, maximizes space in the hatchery, however, survival to juvenile stage (5–10 mm shell height) is reduced. The method chosen depends on the specific strategies selected by the hatchery and on conditions prevalent in the field at the time of transfer. Facilities for both methods are shown here as they are both used in Bermuda. However, should one be chosen over the other, modifications can be easily made to the facility.

4.1.1 Semi-recirculating raceway system (indoor)

Refer to Technical Drawing – page 14. Colour codes are similar to that of other diagrams, in that ambient seawater is coded blue, outflow is coded purple and semi-recirculating flow is coded white.

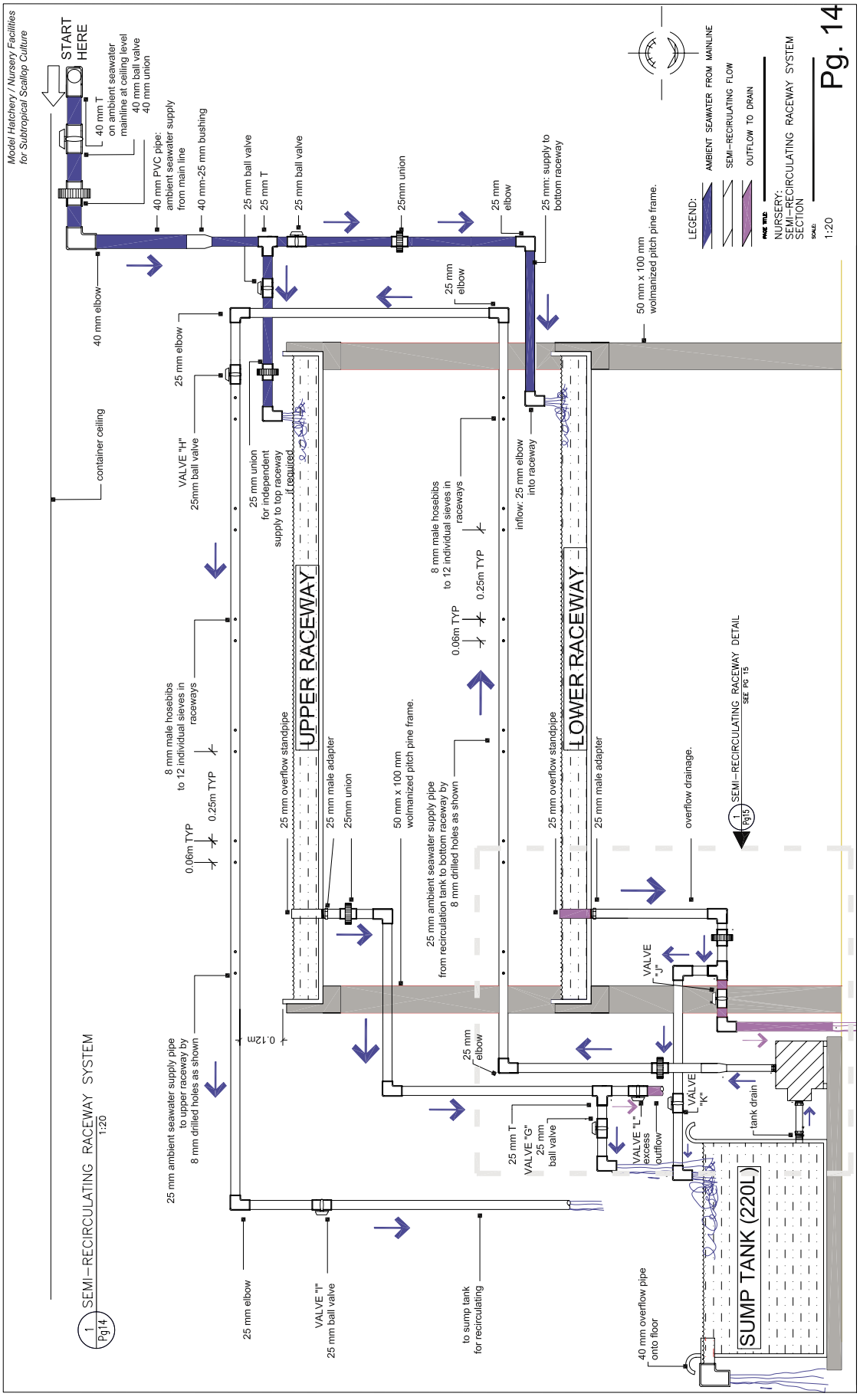
The raceways are two 200x60x15 cm deep fiberglass flow-troughs, with blue gel coated interior and grey pigmented exterior (Red-Ewald Inc.), mounted on a side wall, one above the other, and supported by a wooden frame (60x130 cm). For protection against saltwater the wooden frame is coated with several layers of epoxy. Each raceway has a 25 mm drain hole into which a 25 mm male adapter can be threaded and fitted with an overflow standpipe.

Seawater for the raceway is diverted from the mainline fastened to the ceiling, containing ambient seawater filtered to 1 µm. Diversion is created by a 40 mm T. Flow to the raceway system is regulated by a 40 mm one-way ball valve. A 40 mm union allows for dismantling and cleaning of system. The 40 mm pipe is reduced to 25 mm using a 40 mm to 25 mm bushing. Seawater flow is divided between the top and bottom raceway as it passes through a 25 mm T. Flow is regulated individually to each raceway through a 25 mm ball valve. The fitting of 25 mm unions after each ball valve facilitates cleaning of the pipes at the beginning and end of season. A 25 mm elbow directs the flow into the raceway. This therefore provides ambient seawater to the raceways. For the rearing of spat, the system is usually connected as a semi-recirculating system, where a constant inflow of ambient seawater is provided and partial recirculation of seawater is set. This minimizes the waste of algal food cells provided to the spat and can also be used to control seawater temperature, if needed, during the settlement phase. *Note: seawater control can be affected by manipulating seawater temperature in the sump tank.*

For the semi-recirculation system, a 220 litres sump tank is located on the floor next to the bottom raceway. Overflow of the sump tank is at the top through a 40 mm pipe and spills onto the floor. Discharge rate can be easily monitored using this overflow. Seawater is pumped from the bottom of the tank by a quiet vertical pump (P 95V). *Details and dimensions are given in technical drawing – 1/15A.* Water pumped from the bottom of the sump tank passes through a 25 mm pipe affixed to the wall of the container above the raceways. The recirculation pipe follows the length of the lower raceway, bends upward towards the upper raceway through two elbows, and passes through a 25 mm valve H. This valve is an additional control to the flow of water in the raceways. The 25 mm seawater line continues above the upper raceway and runs to the end of the raceway where a 25 mm elbow directs the flow of water through a one-way ball valve (Valve I) to the sump tank. This recirculated water is supplied to the raceways through 8 mm holes drilled into the pipe running the length of the raceway

Technical drawing, Pg. 14

Nursery: Semi-recirculating raceway system section



sand fitted with male hose barbs. Tygon tubing connected to these hose barbs are cut in pieces long enough to reach individual sieves suspended in the raceway.

Flow for each raceway is therefore twofold: 1) Incoming flow from the ambient seawater line at the right hand side of the raceway, which flows directly into the raceway trough and empties into the sump tank via the drain; and 2) Seawater flow from the sump tank system supplying each sieve separately. A constant water level is maintained in each raceway by the overflow standpipe. Each standpipe is connected to a 25 mm line fitted under the raceway and connected to a 25 mm union for dismantling and cleaning of pipes. A T-junction diverts the water back to the sump tank for recirculation or directly to the outside through the container wall draining into the external 100 mm drain system. The system is identical for both raceways. For the upper raceway, control of flow to drain is regulated by Valve L; for the lower raceway, it is controlled by Valve J.

The degree of semi-recirculation is controlled by Valves K, G, H and I regulating flow into the sump tank, and by Valves J and L, regulating the degree of water discarded from the raceway overflow. To achieve equilibrium, valves are opened in the following manner: Valves H and I are wide open; Valves G and K are 3/4 opened, and valves J and L are fully closed. Any excess water flows out of the sump tank through the overflow pipe. The last two valves J and L are only opened for cleaning of raceways.

4.1.1.1 Details of sump tank

Refer to Technical Drawing – page 15A. Details in Diagram 1/Pg15A show a close-up of connections required. The sump tank drain is a thru-hull fitting (20 mm) connected to the vertical pump via a 20 mm pipe and male adapter. This pump is supplied with 20 mm fittings. The outflow of the vertical pump is conducted through a 20 mm female adapter. Water passes through a 20–25 mm bushing increasing the pipe size to 25 mm. A union facilitates the removal of the pump at this end, and the adapter fittings on either end of the pump aid in its replacement when needed.

The seawater line from the pump is taken back to the wall of the container, and runs parallel to the container wall to supply the raceways (see technical drawing photo – 3/pg15A). Once water has passed along raceway contours (as described in the technical drawing – page 14) it is returned to the sump tank. Additional recirculation is provided from the overflow pipe of each raceway, where seawater is passed through a 25 mm T-junction and controlled by Valve G for the upper raceway, and Valve K for the lower raceway. For cleaning of the raceways and complete drainage, Valves G and K are closed, and outflow is diverted through Valves L and J (upper and lower raceway respectively) for discard (see technical drawing photo – 2/pg15A).

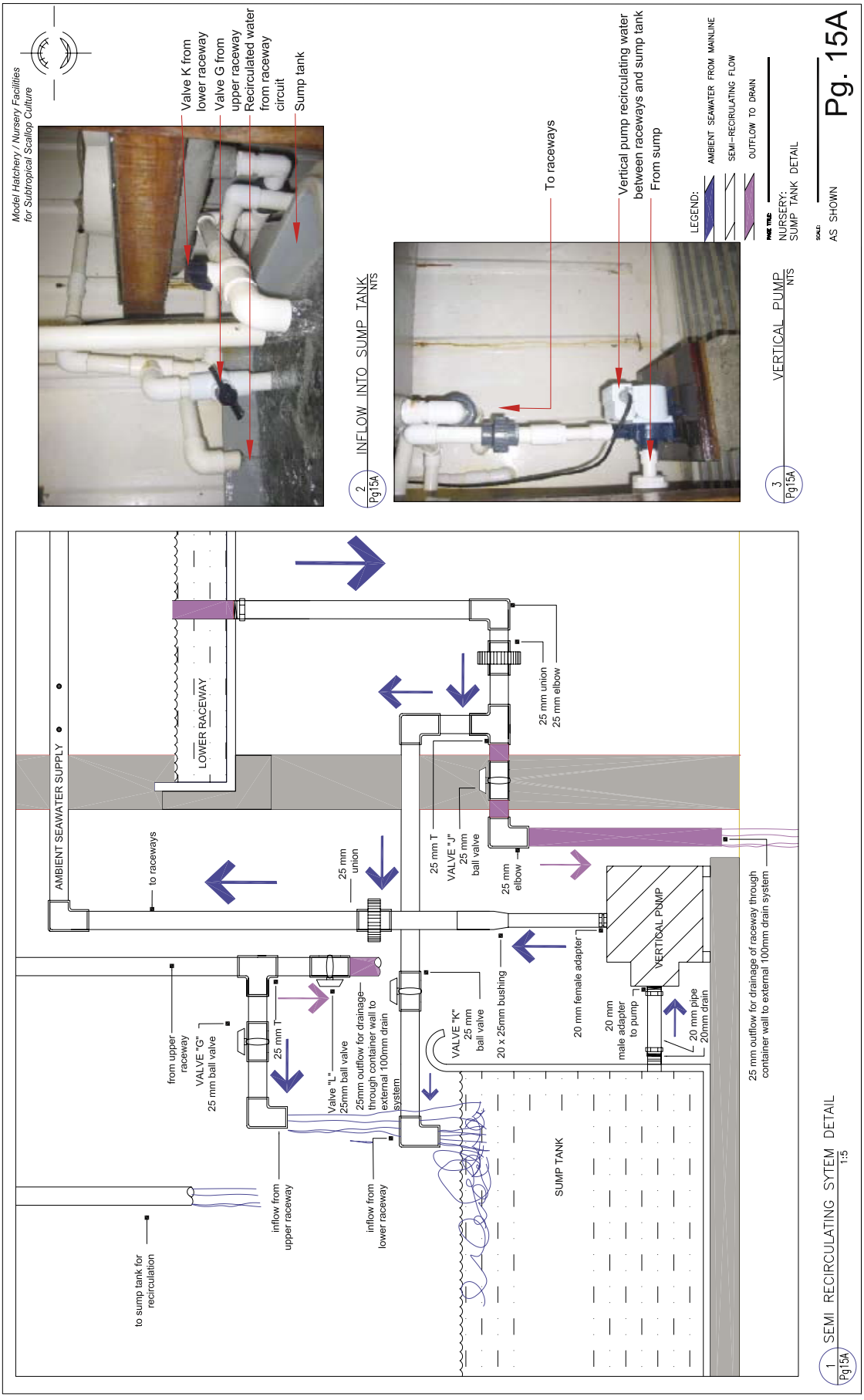
Refer to Technical Drawing – page 15B. The sump tank with overflow discharge and incoming flow is illustrated in Diagram 1/Pg15B. The relative positioning of both raceways and sump tank is seen in Diagram 2/Pg15B. Finally, the sieves used for post-larval rearing and suspended in the raceway, are set as a downwelling system in Diagram 3/Pg15B with incoming seawater flowing into each sieve. Two 25 cm diameter sieves can be placed widthwise and with a total of 12 sieves per raceway. Sieves are suspended by 15 mm transverse pipes resting on the top of the raceway.

4.1.2 Outdoor raceway

Refer to Technical Drawing – page 16A. An experimental outdoor raceway is used to grow 2 mm spat to >5 mm, a size suitable for transfer to 3 mm mesh pearl nets for growout. This is found beneficial as survival following transfer at sea is observed to be dependent on size of spat at transfer. In this outdoor nursery spat are reared in sieves, similar to the indoor raceway, but of slightly larger diameter (30 cm) and of larger mesh

Technical drawing, Pg. 15A

Nursery: Sump tank detail



Technical drawing, Pg. 15B

Nursery: Semi-recirculating system photographs