Appendix C

Proposed Sequencing of Works

Appendix C1

Proposed and Alternative Construction Sequences

Appendix C1 – Proposed and Alternative Construction Sequences

The following are anticipated sequencing of works for the bathing beach development, together with the alternative sequencing of works (the changes in italics) and its environmental benefits and dis-benefits.

Anticipated Sequencing of Works	Environmental Benefits/Dis-Benefits	Alternative Sequencing of Works	Environmental Benefits/Dis-Benefits
Site Formation for Car Park & Beach Building Area			
– Site Clearance – Site formation for the car park and beach building area, including excavation/dredging for foundations for the seawall/retaining wall. – Construction of the seawall / retaining walls – Backfilling for car park only, leaving the existing ground for beach buildings – Handover the beach building area to ArchSD for their contractor to construct the building. – Landscaping	The backfilling works will not be carried out for the beach building area, which will not create unnecessary plant noise and dust nuisance. This will create time for other construction works.	– Site Clearance – Site formation for the car park and beach building area, including excavation and dredging for foundations for the seawall/retaining wall. – Construction of the seawall / retaining walls – *Backfilling for car park and building area* – *Handover the beach building area to ArchSD for their contractor to construct the building, who will need to excavate for their foundation.* – Landscaping	The need to backfill and then later excavate the backfilled area for the construction of the building foundations will create extra plant noise and dust control. This will also be extra time consuming for the contractor. Therefore, this alternative was not considered.
Road Widening, Roadworks, Utilities, Drainage and Sewerage Works			
– Temporary traffic management in different stages – Utilities detection to avoid damage during excavation – Excavation works and/or sheet piling for road drainage, sewerage and utilities works – Drainage and sewerage diversion works – Construct manholes, pipelines and utilities works concurrently – Backfilling of trenches – Milling or excavation of existing road – Construction of roadworks	The works have been sequenced to minimise public nuisance as well as limiting the excavation works to avoid extensive excavation as well as abortive excavation. Therefore, common trenches should be arranged for the works.	– Temporary traffic management in different stages – Utilities detection to avoid damage during excavation – Excavation works and/or sheet piling for road drainage, sewerage and utilities works – Drainage and sewerage diversion works – *Construct manholes, pipelines and utilities works individually* – Backfilling of trenches – Milling or excavation of existing road – Construction of roadworks	To carry out the excavation trenches for the each individual elements of the work will end up with abortive excavation works. Therefore, this would create more dust and plant noise due to more excavation. The construction duration will also be lengthened, creating a nuisance to the public. As such, this sequencing of works is not preferred.

Anticipated Sequencing of Works	Environmental Benefits/Dis-Benefits	Alternative Sequencing of Works	Environmental Benefits/Dis-Benefits
Groyne Construction, Dredging and Sand Filling			
– Site clearance – Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore – Install silt curtain – Carry out dredging for groyne and seabed – Construct west groyne and east groyne – Carry out sand filling offshore – Landscaping	The sequence of work is to ensure that the sand filling dispersion will be minimised.	– Site clearance – Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore – Install silt curtain – Carry out dredging for groyne and seabed – *Carry out sand filling offshore* – *Construct west groyne and east groyne* – Landscaping	To carry out the sand filling and groynes concurrently will create more sand dispersion and therefore would be environmental disbenefit. Therefore, this alternative was not considered.

Appendix C2

Proposed Construction Sequences

Appendix C2 – Proposed Construction Sequences

The following are anticipated sequencing of works for the bathing beach development, which include the construction plants.

1. Construction of Ramp, Staircase, Vertical Seawalls, Retaining Walls, and their Foundations

The following sequencing of works is anticipated:

Vertical seawalls and retaining walls will be constructed with concrete blocks and therefore the final location will be open cut by excavators. The concrete block will be precast and brought to site by lorries and then placed on site with a mobile crane. Backfilling of void be carried out by lorries with backfill, excavator and vibratory roller. However, as for the other structures, the following sequencing of works is anticipated:

- Open cut excavation will be also be adopted for the construction of the foundations for other structures;
- Exposed temporary sloping surface will be covered by plastic sheet or similar for protection against rainfall / surface infiltration;
- A crane will be required for lifting construction materials in place;
- Timber sawing machine, reinforcement bar bender, electrical drills, diesel generator, water pumps and concreting vibratory pokers will be required for the construction of the structures;
- Concreting of structures;
- Backfilling of void by excavator; and
- Compaction and leveling of fill by roller compactor or vibration compactor.

2. Construction of Beach Buildings and their Foundations

The following sequencing of works is anticipated:

- It is anticipated that raft foundation will be adopted for the superstructure foundation. The construction of foundation will involve excavator, water pump, timber sawing machine, reinforcement bar bender, electrical drill, diesel generator and concreting vibration compactor.
- A crane will be required for lifting material E&M plants or concrete into the required site locations; and
- Falseworks, timber sawing machine, reinforcement bar bender, electrical drill, diesel generator and concreting vibration compactor will be required for the construction of the superstructure.
- Concreting of structures with concrete lorry mixers and vibratory pokers
- Removal and disposal of formwork.

3. Construction of paving area for car park

The following sequencing of works is anticipated:

- Excavators will be required for excavation of area above future site formation level;
- Area below future site formation to be filled by truck and leveling by excavator;
- A roller compactor and vibration compactor will be required for the compaction of the backfilling material and sub-base for the construction of the car park pavement; and
- Concreting of paved area of car park using concrete lorry mixers and vibratory poker.

4. Road Pavement Construction (this work will be carried out concurrently or in stages with the construction works for utilities, watermain, drainage and sewerage)

- Excavator to excavate to design level;
- The formation will be compacted by a roller compactor;
- The sub-base will be laid and compacted by roller compactor;
- The road base will be laid in two layers by a paver/ leveler.
- Each layer will be placed and compacted by a smooth vibratory tandem three wheeled steel wheeled roller and follow by a smooth non vibrating pneumatic tyre-roller in longitudinal direction.
- The edge area i.e. bitumen laid adjacent to kerbs, covers, frames or other street furniture will be compacted using suitable hand held mechanical compaction plant;
- The remaining bituminous layers, the base course, regulating course and wearing course will be laid initially using the steel wheeled roller then followed by a smooth wheeled non vibratory roller.

4.1 Construction of New Sewage Pipeline and Manholes

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using pneumatic breaker with a diesel generator break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new sewer pipes;
- Install sheet pile to stabilize the trench using backhoe with silent piler;
- Further excavation by excavator and expose existing sewage pipeline and manhole and the connection points;

- Construct the manholes and section of sewage pipeline using a crane, backhoe; timber sawing machines, reinforcement bar benders, electrical drill, diesel generator, and concreting vibratory pokers and concrete lorry mixers;
- Backfill trench using excavator and vibratory roller;
- Remove sheet piles and reinstated the existing road. Silent piler to remove the sheet piles.

4.2 Construction of New Drainage Pipeline Gullies

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using electrical drill (two to three numbers) with a diesel generator (two numbers) to break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new drainage pipes;
- Install sheet pile to stabilize the trench using backhoe (one to two numbers) with a low-noise hydraulic hammer machine (one to two number) or vibration hammer (one or three numbers);
- Further excavation by one to two backhoes (excavator) and expose existing drainage pipeline and connection points;
- Construct the gullies and drain pipes using a crane (one number) or backhoe (one to two numbers);
- Backfill trench using backhoe (one to two numbers) and compactor (one to two numbers).

4.3 Laying of Watermains and Utilities

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using pneumatic breaker with diesel generators to break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new drainage pipes;
- Excavation by excavator to founding level;
- Construct the cross road ducts by hand or watermain by use of excavator;
- Backfill trench using backhoe and vibratory roller.

5. Construction of Western Box Culvert

- Construction of the western box culvert will be carried out during dry season.
- Temporary drainage systems will be established, as appropriate, such as perimeter cut-off drains, pumping and sedimentation control for proper discharge of the collected runoff to the designated discharge points approved by EPD;
- Water flow at the existing culvert will be temporarily diverted by sand bags and the collected water will be pumped and properly discharged. Therefore, works area will be isolated from the existing water flow to avoid any contamination on the stream;
- Install sheet pile to stabilise the two banks next vertical wing walls using backhoe with a silent piler;
- Saw cutting machine will be used to cut line for demarcating the area of existing concrete to be demolished;
- Pneumatic breakers, electric drill, diesel generator and electrical water pump will be used during the demolition and preparation of the concrete slab surfaces;
- Drill lifting holes by electronic drill to hang the panels to be demolished and hang up the walls by crane;
- Break the existing concrete until rebar have been exposed. Then, cutting of all rebars by saw cutting machine;
- Lift the panels safely to the level ground away from the existing river and further demolish the panels by backhoe with concrete breaker head;
- Removal of existing concrete debris by excavator;
- Further excavation by excavator to form the formation level of the box culvert; Excavated material to move to stockpile area by truck;
- The existing concrete surface of the culvert shall be repaired to receive new culvert movement joints. Install a movement joint at the interface between existing culvert and the new culvert.
- The culvert bottom slab, as well as their vertical walls, is anticipated to be cast in situ by concrete lorry mixer;
- A crane will be required as well as timber sawing machine, reinforcement bar bender, electrical drill, diesel generator, and concreting vibration pokers;
- After erecting falseworks, formwork and fixing rebar, the culvert top slab can be cast in situ. It is anticipated to be cast in situ by concrete lorry mixer and vibratory poker;
- Divert the water flow to the new culvert by removal of sand bags;
- Remove sheet piles and reinstated the existing slope profiles using silent piler and excavator.

6. Construction of Western Drainage Open Channel

- Carry out cable detection to confirm no utilities running along the channel banks;
- Install sheet pile to stabilise the trench using excavator and silent piler;
- Install silt curtain at the outlet of the open channel prior to carrying out of excavation works for construction of the channel banks near the outlet;
- Excavate to proposed level using excavator. Excavated material to be transported by trucks to stockpile area;
- Compact the design formation level with a vibratory roller;
- Transport rockfill and gabion cage by trucks;
- Install gabion blocks layer by layer and amour rock by crane;
- Construct rubble bedding by excavator and manually;
- Backfill the back of gabion walls by excavator and compact the fill material with vibratory roller;
- Remove sheet piles by silent piler and slope reinstatement by excavator and vibratory roller;
- Remove silt curtain at the channel outlet.

7. Construction of Modification Works on Existing Box Culvert

- The proposed modification works on the existing eastern box culvert will be carried out during dry season.
- Establish temporary drainage systems, as appropriate, such as perimeter cut-off drains, pumping and sedimentation control for proper discharge of the collected runoff to the designated discharge points approved by EPD;
- A temporary barrier will be formed by sand bags and the collected water will be pumped and properly discharged;
- Prepare the surface of concrete bottom slab for the new concrete infilling with plants of electrical drills, diesel generators and electrical water pumps;
- Install a movement joint at the interface between existing culvert and the proposed eastern box culvert;
- Erect steel formwork using hand tools at low tide;
- Concreting with concrete lorry mixers and vibration pokers;
- Remove formwork.

8. Construction of 90m long Eastern Box Culvert

- The existing one tonne bermstones, pell mell rubble in front of existing seawall Type 1 and 4 will be maintained;
- Carry out preloading on the existing ground with settlement monitoring;
- Remove the surcharge and install temporary support for the existing vertical seawall if necessary;
- Install silt curtain as precaution measures around the works area and carry out excavation works up to the designed formation level of the proposed box culvert during low tide;
- Layering geotextile onto the seabed;
- Place bermstone, pell mell rubble, levelling stone and pre-cast blocks underneath the proposed box culvert by excavator;
- The base slab of the proposed box culvert will be formed by precast panel segments of about 5m wide off site or in a separate location of the site area. It can be delivered by land transport and place above the level stones stage by stage. A crane will be required during precast segment erection stage.
- Timber sawing machines, reinforcement bar benders, electrical drill, diesel generator, and concreting vibratory pokers and concrete lorry mixers will be required for the construction of the proposed box culvert with the cast in-situ side walls and top slab;
- Installation/construction of the connection segment to the existing box culvert will be carried out during dry season.
- Concrete topping/screeding will be laid to form required culvert gradient profile using vibratory pokers and trowels;
- The planter wall will be also cast in situ. A crane, concrete lorry mixers and vibratory pokers will be required during concreting of the planter;
- Divert water flow to the new box culvert by removal of sand bags and pumping facilities;
- Backfill the box culvert and planter wall to the designed level by excavator and roller;
- Remove silt curtain.

9. Groyne Construction:

- Erect the benchmarks and the temporary tide gauges and checked by the land surveyors;
- Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore;
- Install silt curtain;
- Carry out dredging down to the proposed founding level of the groyne using excavators on land above low water mark and grab dredger and derrick lighter on sea (below average low water mark).
- Check the dredged profile and condition of dredged trench bottom by echo sounding and by divers respectively;
- On landward (above average low water mark). Laying geotextile onto the dredged trench, carry out grab placing of rock fill to the dredged trench as well as end tipping and placing of rock armour using trucks and excavators.
- On seaward (below average low water mark) Laying geotextile onto the dredged trench, carry out grab placing of rock fill to the dredged trench as well as grab placing of rock armour by derrick barge with derrick lighter;
- Carry out land survey of the as-built profile of the rock fill layer;
- Environmental monitoring and audit to be carried out regularly during dredging and armour rock filling;

10. Dredging and Sand Filling:

- Install the agreed environmental monitoring stations and carry out monitoring and audit regularly during dredging and sand filling;
- Carry out dredging onshore by excavators and offshore by grab dredger with derrick lighter and the dredging area should be protected with movable type silt curtain;
- Check the dredged profile and condition of dredged trench bottom by echo sounding and by divers respectively;
- Install standing type silt curtain to cover the whole area with sandfilling works;
- Carry out sand filling offshore by a backfilling barge (sand filling via a set of conveyor belt on barge (can be pelican barge), which is extended to the sand filling area offshore); and on land, leveling of sand beach by bulldozer and backhoe.