Appendix E - Steensby and Rail Camps Freshwater Supply, Sewage and Wastewater – Plans for Future Work

There will be no construction and development of Steensby and the Rail camps during 2014 and work is not planned for the immediate future. Updates to these sections of the Plan will be done when required and will be included in a future Annual Report to NWB as required by Part B, Item 4 of existing Type A Water Licence (2AM-MRY1325). Block flow Diagrams for Steensby and Railway Camps will be updated when required.

E.1 Freshwater

E.1.1 Freshwater System Process Description

E.1.1.1 Steensby Port Site

During 2013, there are no construction activities planned for Steensby Inlet. During the future construction phase the on-site population will be approximately 600 people. Half the camp personnel will be accommodated on a barge which will be equipped with potable water treatment systems. The potable system onboard the barge will be a reverse osmosis based system. The full configuration will include coagulation, filtration by media filter, reverse osmosis and chemical disinfection. The remaining personnel will be accommodated by a land based potable water treatment system. This system will continue to operate during the operation phase while the barge based system will only be used during the construction phase.

The existing fresh water equipment will not be used and a new fresh water distribution system will be installed. The fresh water demand for construction and operation are shown on the drawing Steensby Site - Water Supply Balance Block Flow Diagram in Appendix A.

For the land based system, a heated and insulated pump house will be built at Lake ST347 with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression, stockpile dust suppression, concrete and explosives manufacturing will be provided directly from nearby lakes using vacuum truck.

The land based potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine. The vessel based potable water treatment scheme will include the same equipment as well as a membrane based system to desalinate the seawater source.

E.1.1.2 Mid-Rail Site

During 2013, there are no construction activities planned for the Mid-Rail Site. During the future construction phase the on-site population will be approximately 200 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Mid-Rail - Water Supply Balance Block Flow Diagram in Appendix A.

A heated and insulated pump house will be built at adjacent Unnamed Lake with duty/standby pumps to deliver fresh water to a fresh water tank during summer. During winter water will be trucked from Ravn Camp Lake to the fresh water tank. This tank will be located in close proximity to the new potable water treatment plant. Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

E.1.1.3 Ravn River Site

During 2013, there are no construction activities planned for the Mid-Rail Site. During the future construction phase the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Ravn River - Water Supply Balance Block Flow Diagram in Appendix A.

A heated and insulated pump house will be built at Ravn Camp Lake with duty/standby pumps to deliver fresh water to a fresh water tank (to be located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

E.1.1.4 Cockburn Tunnels Camp Site (Cockburn North Camp)

During 2013, there are no construction activities planned for the Cockburn Tunnels Camp Site. During the future construction phase the on-site population will be approximately 100 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn Lake Tunnels Camp - Water Supply Balance Block Flow Diagram in Appendix A.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

E.1.1.5 Cockburn South Camp Site

During 2013, there are no construction activities planned for the Cockburn South Camp Site. During the future construction phase the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn South - Water Supply Balance Block Flow Diagram in Appendix A.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

E.2 Sewage Treatment

E.2.1 Sewage Treatment Process Description

E.2.1.1 Steensby Site

During the construction and operation phase the camp population will increase to approximately 600 people. There is no planned construction at Steensby Site during 2013.

During construction start-up, sewage generated by the workforce will be treated in an existing sewage treatment plant that is on-site but not yet installed. During the construction phase 300 people will be accommodated by a temporary sewage treatment system in place for the construction period. In addition, the temporary sewage treatment plant will be designed to process raw or partially treated sewage from the Cockburn lake rail camps which will be conveyed to the Steensby temporary sewage treatment facility by truck. The remaining workforce will be accommodated by a permanent sewage treatment system which will remain in service during the operation phase.

These sewage treatment plants will be housed in a temperature controlled areas and as such their performance will not be negatively impacted by arctic conditions.

Effluent from the sewage treatment plants will be stored in effluent tanks. The effluent tanks will have a hydraulic retention time of two days (at minimum) based upon nominal flows. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity. This will improve the quality of the effluent in the tank. The volume is sufficient to allow for periodic sampling and testing of the treated effluent before discharge or reuse. The new permanent sewage treatment facility will be RBC based technology or superior. Treated effluent will be discharged to the ocean.

The equalization tank that feeds the temporary sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary. The incinerator design will consider the solids content of the sludge from the dewatering device.

The equalization tank that feeds the new sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary.

E.2.1.2 Mid-Rail and Ravn River Sites

Sewage waste generated at the Ravn River and Mid-Rail camps and Sewage generated at the Cockburn North and Cockburn South camps at either the Mine Site Sewage Treatment Facility or the Steensby Port Sewage Treatment Facility, unless otherwise approved by the Board in writing.

Sewage generated at these sites will be conveyed to the Mary River permanent sewage treatment facility by truck. During the first year when there will only be access to the camp via an ice road, sewage can only be trucked from January to April. During the remaining months the sewage will be stored. There would be an opportunity to partially or fully treat sewage prior to storage. Sewage storage facilities may be aerated to prevent the waste becoming septic (generating odours and noxious gases). Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the mine site. Given the quantity of waste to be moved or stored every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites. An amendment to the Type A Water Licence would be required to support this option.

The equalization tank at Mary River will be sized to provide sufficient residence time for freshly added sewage from the Mid-Rail or Ravn River to mix with sewage generated at the Mine Site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the mine site.

E.2.1.3 Cockburn Tunnels (Cockburn North) and Cockburn South Sites

Sewage generated at these sites will be conveyed to the Steensby permanent sewage treatment facility by truck. Raw to partially treated sewage will be conveyed to Steensby Inlet by means of established roads along the rail alignment or by ice road. Depending on the volume of sewage to be stored at site, the sewage storage facilities will be sized accordingly. At the north camp there will only be access to the camp via an ice road and as such sewage can only be trucked from January to April. During the remaining months the sewage will be stored. Sewage storage facilities will be aerated to prevent the waste becoming septic (generating odours and noxious gases). There will be the opportunity to partially or fully treat sewage prior to storage. Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the Steensby site. Given the quantity of waste to be moved every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites. An amendment to the Type A Water Licence would be required to support this option.

The equalization tank at Steensby will be sized to provide sufficient residence time for freshly added sewage from the Cockburn Tunnels (Cockburn North) and Cockburn South camps to mix with sewage generated at the Steensby site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the Steensby site.

E.2.1.4 Design Considerations from 'Lessons Learned'

Previous studies had recommended the use of Polishing Waste Stabilization Ponds (i.e. Mary River Project Appendix 10D-3 Wastewater Management Plan SD-EMMP-003, March 31, 2010) followed by a secondary waste polishing system. The existing infrastructure at the Mary River (mine site) and Milne sites includes these ponds in part to allow for secondary treatment of the sewage treatment plant (STP) effluent which was not meeting the phosphorus discharge limit. However, based upon practical experience at the site with the STP it was projected that a secondary polishing system will not be required in the future.

The new systems will be installed with temporary storage ponds for off-spec water but will not require secondary polishing for the following reasons:

- The proposed new STPs will be based on membrane technology. This technology produces better quality effluent, is less susceptible to the impact of varying loads and has shorter start-up periods.
- The STP trains will be better able to handle upsets by using the available spare capacity to operate the equipment at more conservative flow rates.
- The existing equipment (at the Mine Site) was designed to meet a phosphorus discharge criteria of 0.5 mg/L. The new STPs shall be designed to meet a much lower phosphorus discharge criteria of <0.1 mg/L.

Sewage Treatment equipment vendors will be assessed based upon their experience producing equipment for arctic environments.

E.2.2 Oily Water/Wastewater Treatment Process Description

The process descriptions for both oily water/wastewater treatment systems for Steensby are described in the section that follows.

E.2.2.1 Steensby Site

Future Construction and Operation Phase

Oily water may be generated from the following sources (this neglects minor oily water generated from accidental spills which will be handled by the spill management plan):

- Vehicle maintenance and wash facilities (i.e. truck wash, equipment and floor wash down water).
- Fuel tank farm run-off.
- Emulsion plant wash water.
- Freight dock.
- Airstrip.

The vehicle maintenance and wash facility will have a sump located in close proximity to the maintenance facilities. Wash water produced in the maintenance facility (truck washing, equipment and floor washdown) will flow by gravity and be collected in the local sump. Suspended material in the wastewater will settle in the sump. Free oil in the wastewater will be removed by an oil/water separator system in order to meet the required oil discharge limits. The waste will then be further treated in the oily water treatment plant by activated carbon and clay to meet other specific parameters. The effluent will then be pH adjusted, if required, to meet discharge criteria.

Treated effluent from the oily water treatment plant will be pumped to discharge, or recycled and reused as washdown water at the maintenance shops. The separated waste oil will be stored in a local tank. Periodically, the oil will be drained and reused if possible or incinerated. Accumulated suspended solids will be periodically removed by bucket loader vehicle and sent to a land fill for disposal.

Run-off from the tank fuel storage areas will have to be treated by a local oily water separator system that will be used as needed. The resulting water will be discharged directly to the receiving body (Steensby – Ocean). The water will be periodically tested such that if any parameter is out of compliance the water will be removed by vacuum truck and treated in the vehicle maintenance shop wastewater treatment plant.

Run-off water from the freight dock will be collected and treated in a manner similar to the treatment scheme for the run-off from the tank fuel storage areas.

The emulsion plant shall be supplied with its own wastewater treatment plant which utilizes an evaporation system to evaporate the water leaving solid residue and oil. This residue will be tested for toxicity and if necessary taken off-site for disposal in a licensed facility otherwise the waste will be land filled.

Run-off water from the air strip run-off also has the potential for some oily water content. As such, this water will be collected through a drainage system and transported as needed by vacuum truck to the vehicle maintenance shop wastewater treatment plant.

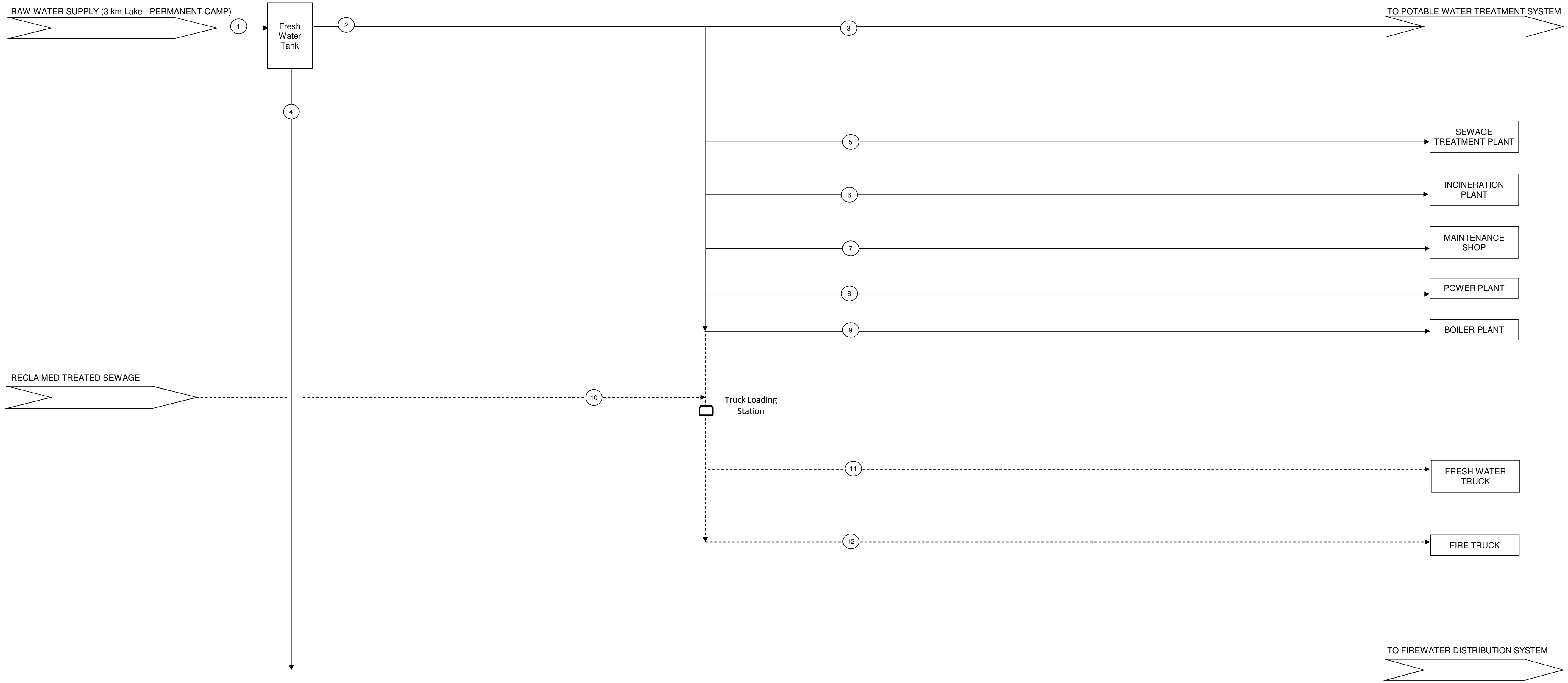
Small amounts of propylene glycol will be used for de-icing of aircraft. The spent propylene glycol will be collected, stored in containers and sent by ship off-site to a licensed treatment/disposal facility. Some interim treatment of the spent propylene glycol may occur to reduce the overall waste volume generated. This will be evaluated during the detailed design.

Some dust suppression solution will be applied to roads at the Steensby site. The suppressant will be DL-10. This is an asphalt based emulsion and as such some water will be consumed for the dilution of the solution. This is an approved dust suppressant as specified by the Nunavut Department of Sustainable Development Environmental Protection Service (Environmental Guideline for Dust Suppression).

In addition some Calcium Chloride solution will be used for drilling activities. The spent brine will be applied to nearby roads as a dust suppressant. This is an approved dust suppressant as specified by the Nunavut Environmental Protection Service. Treated oily water will be blended with treated sewage and discharged or discharged directly based on sampling.

E.2.2.2 Rail Camps

Two tunnels are to be built along the railway and a small amount of water will be consumed in the tunnelling operation. Calcium Chloride brine solution is used for tunnelling. This waste brine generated during the tunnelling will be collected and disposed of as per the Waste Management Plan for Construction, Operation and Closure. In addition some Calcium Chloride solution will be used for drilling activities.



LEGEND:
CONTINUOUS FLOW.
INTERMITTENT FLOW.

NOTES:
1) The peak flows for the accommodation facilities were determined using a peaking factor.
2) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
3) Bottled water distribution by pickup truck is not shown but will be in use to provide potable water to some remote facilities.

Stream No.	1	2	3	4	5	6
Stream Description	RAW WATER SUPPLY	PIPED FRESH WATER	FEED TO PWTP	FIREWATER	WASH WATER TO STP	WASH WATER TO INCIN. PLANT
Construction Phase - Design (m^3/h)	6.5	10.6	6.6	300.0	1.0	1.0
Construction Phase - Nominal (m^3/h)	5.2	5.2	4.5	0.0	0.0	0.0
Operation Phase - Design (m^3/h)	7.1	21.6	6.6	300.0	1.0	1.0
Operation Phase - Nominal (m^3/h)	5.7	5.7	4.5	0.0	0.0	0.0
Stream No.	7	8	9	10	11	12
Stream Description	WASH WATER TO MAINTENACE SHOP	WASH WATER TO POWER PLANT	WASH WATER TO BOILER PLANT	RECLAIMED WATER	TRUCKED FRESH WATER	FIRE TRUCK WATER
Construction Phase - Design (m^3/h)	0.0	1.0	1.00	42.86	42.9	42.9
Construction Phase - Nominal (m^3/h)	0.0	0.1	0.01	2.54	3.0	0.00
Operation Phase - Design (m^3/h)	11.0	1.0	1.00	42.86	42.9	42.9
Operation Phase - Nominal (m^3/h)	0.7	0.1	0.01	0.00	0.3	0.00

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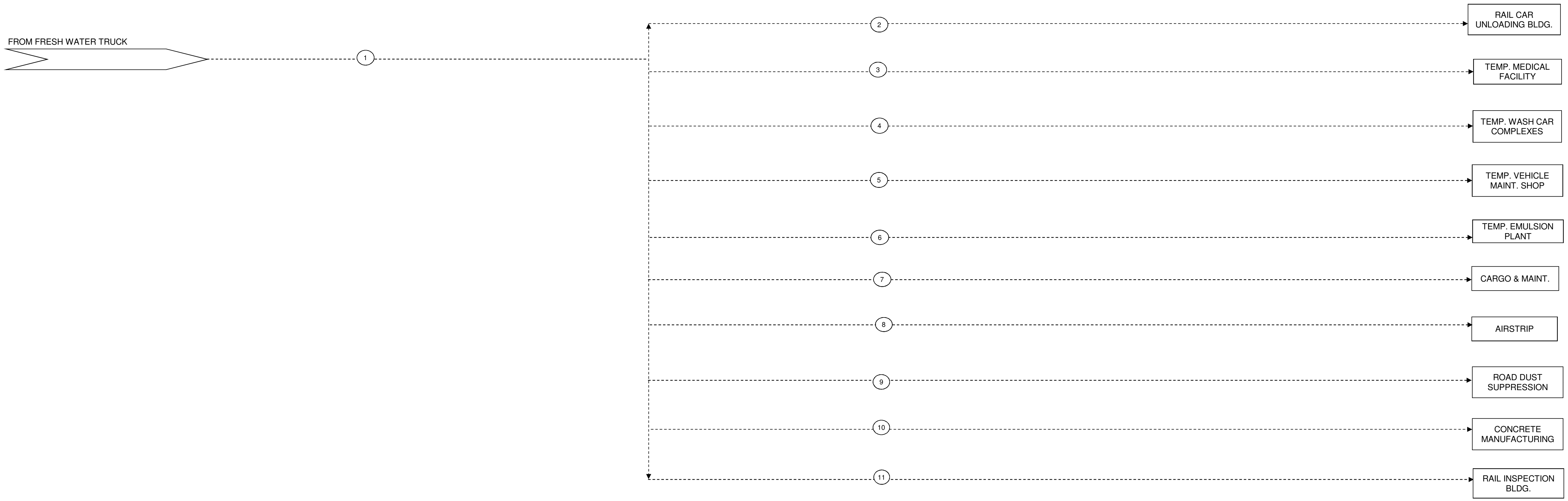
DESIGNED BY R. KAPADIA Date: 12/21/2011	DRAWN BY R. KAPADIA Date: 12/21/2011	**STEENSBY - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **PERMANENT CAMP - WATER SUPPLY BALANCE**
CHECKED BY R. RADAKOVIC Date: 12/21/2011	DISCIP ENGR. R. KAPADIA Date: 12/21/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/21/2011	
PROJECT MANAGER H. CHARALAMBU Date: 12/21/2011	Drawing No. H337697-4510-10-002-0001 SHEET 1 OF 5	Rev. F



LEGEND:

———— CONTINUOUS FLOW.

- - - - - INTERMITTENT FLOW.

NOTES:

1) The peak flows for the accommodation facilities were determined using a peaking factor.
2) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
3) Bottled water distribution by pickup truck is not shown but will be in use to provide potable water to some remote facilities.

Stream No.	1	2	3	4	5	6	7	8	9	10	11
Stream Description	FROM FRESH WATER TRUCK	FRESH WATER TO RAIL CAR UNLOAD BLDG.	FRESH TO TEMP. MEDICAL FACILITY	FRESH TO TEMP. WASH CAR	FRESH TO TEMP. VEHICLE SHOP	FRESH TO EMULSION PLANT	FRESH TO CARGO & MAINT. BLDG.	FRESH TO AIRSTRIP	FRESH FOR ROAD DUST SUPPRESS	FRESH FOR CONCRETE MFG.	FRESH FOR RAIL INSPECTION BLDG.
Construction Phase - Design (m^3/h)	42.9	42.9	42.9	42.9	42.9	42.9	42.9	42.9	42.9	42.9	42.9
Construction Phase - Nominal (m^3/h)	3.01	0.01	0.0	0.1	1.1	0.5	0.0	0.0	0.1	0.9	0.1
Operation Phase - Design (m^3/h)	42.9	42.9	-	-	-	-	42.9	42.9	42.9	42.9	42.9
Operation Phase - Nominal (m^3/h)	0.33	0.01	0.04	-	-	-	0.01	0.01	0.13	-	0.12

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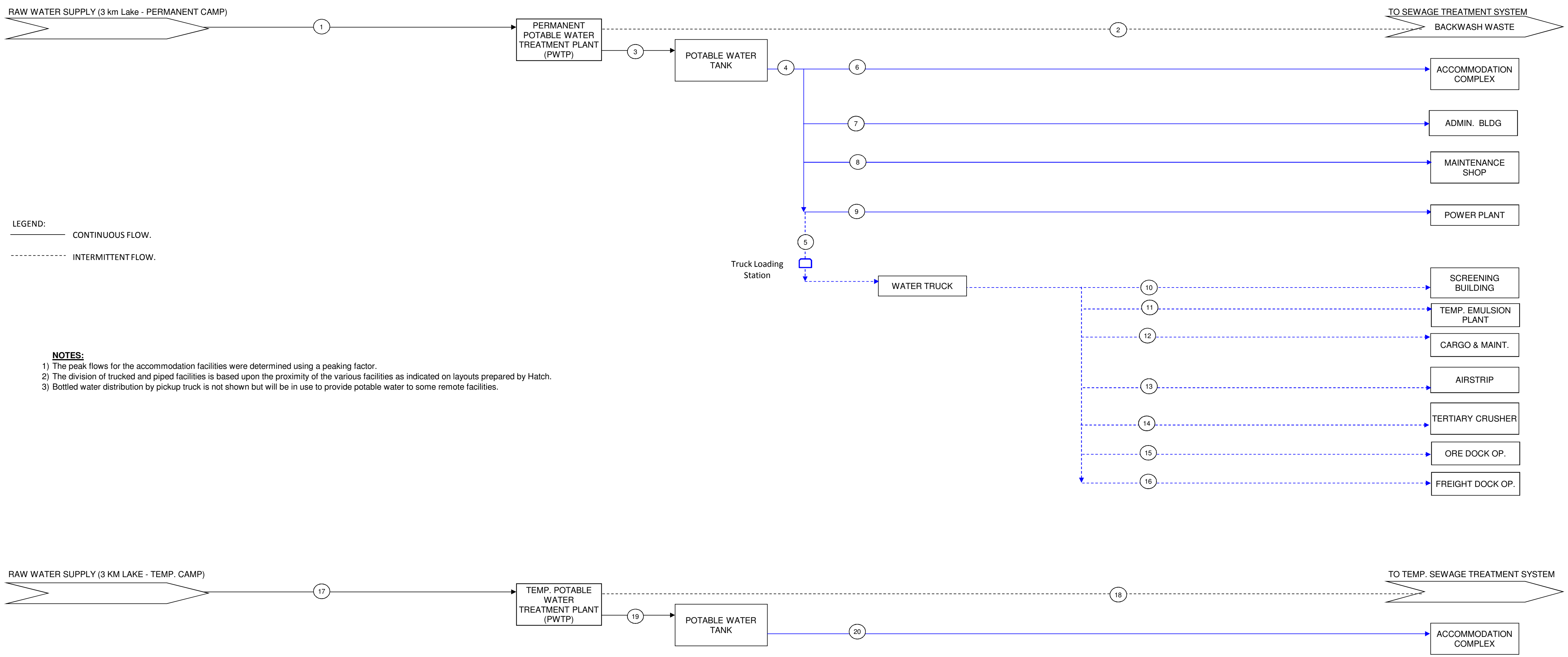
DESIGNED BY R. KAPADIA Date: 12/21/2011	DRAWN BY R. KAPADIA Date: 12/21/2011	STEENSBY - MARY RIVER PROJECT BLOCK FLOW DIAGRAM TEMPORARY CAMP - WATER SUPPLY BALANCE
CHECKED BY R. RADAKOVIC Date: 12/21/2011	DISCIP ENGR. R. KAPADIA Date: 12/21/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/21/2011	
PROJECT MANAGER H. CHARALAMBU Date: 12/21/2011	Drawing No. H337697-4510-10-002-0001 SHEET 2 OF 5	Rev. F



NOTES:

1) The peak flows for the accommodation facilities were determined using a peaking factor.
2) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
3) Bottled water distribution by pickup truck is not shown but will be in use to provide potable water to some remote facilities.

Stream No.	1	2	3	4	5	6	7	8	9	10
Stream Description	FEED TO PWTP	WASTE FROM PWTP	PRODUCT FROM PWTP	PIPED POTABLE WATER	TRUCKED POTABLE WATER	POTABLE TO ACC. COMPLEX	POTABLE TO ADMIN. BLDG.	POTABLE TO MAINTENANCE SHOP	POTABLE TO POWER PLANT	POTABLE TO SCREENING BLDG.
Construction Phase - Design (m^3/h)	6.6	0.003	5.6	72.8	42.9	22.3	3.8	3.8	-	42.9
Construction Phase - Nominal (m^3/h)	4.5	0.002	4.5	4.5	0.8	0.9	1.3	1.5	-	0.1
Operation Phase - Design (m^3/h)	6.6	0.003	5.6	61.5	42.9	14.9	1.4	1.9	0.5	42.9
Operation Phase - Nominal (m^3/h)	4.5	0.002	4.5	4.5	0.2	3.1	0.4	0.7	0.1	0.1
Stream No.	11	12	13	14	15	16	17	18	19	20
Stream Description	POTABLE TO EMULSION PLANT	POTABLE TO CARGO & MAINT. BLDG.	POTABLE TO AIRSTRIP	POTABLE TO TERTIARY CRUSHER	POTABLE TO ORE DOCK OP.	POTABLE TO FREIGHT DOCK OP.	FEED TO TEMP. PWTP	WASTE FROM TEMP. PWTP	PRODUCT FROM TEMP. PWTP	POTABLE TO TEMP. ACC. COMPLEX
Construction Phase - Design (m^3/h)	42.9	42.9	42.9	42.9	42.9	42.9	27.0	0.003	27.00	27.00
Construction Phase - Nominal (m^3/h)	0.3	0.03	0.05	0.05	0.2	0.2	4.5	0.002	4.50	4.50
Operation Phase - Design (m^3/h)	42.9	42.9	42.9	42.9	42.9	42.9	0.0	0.000	0.00	0.00
Operation Phase - Nominal (m^3/h)	0.03	-	0.001	0.05	0.04	0.0	0.0	0.000	0.00	0.00

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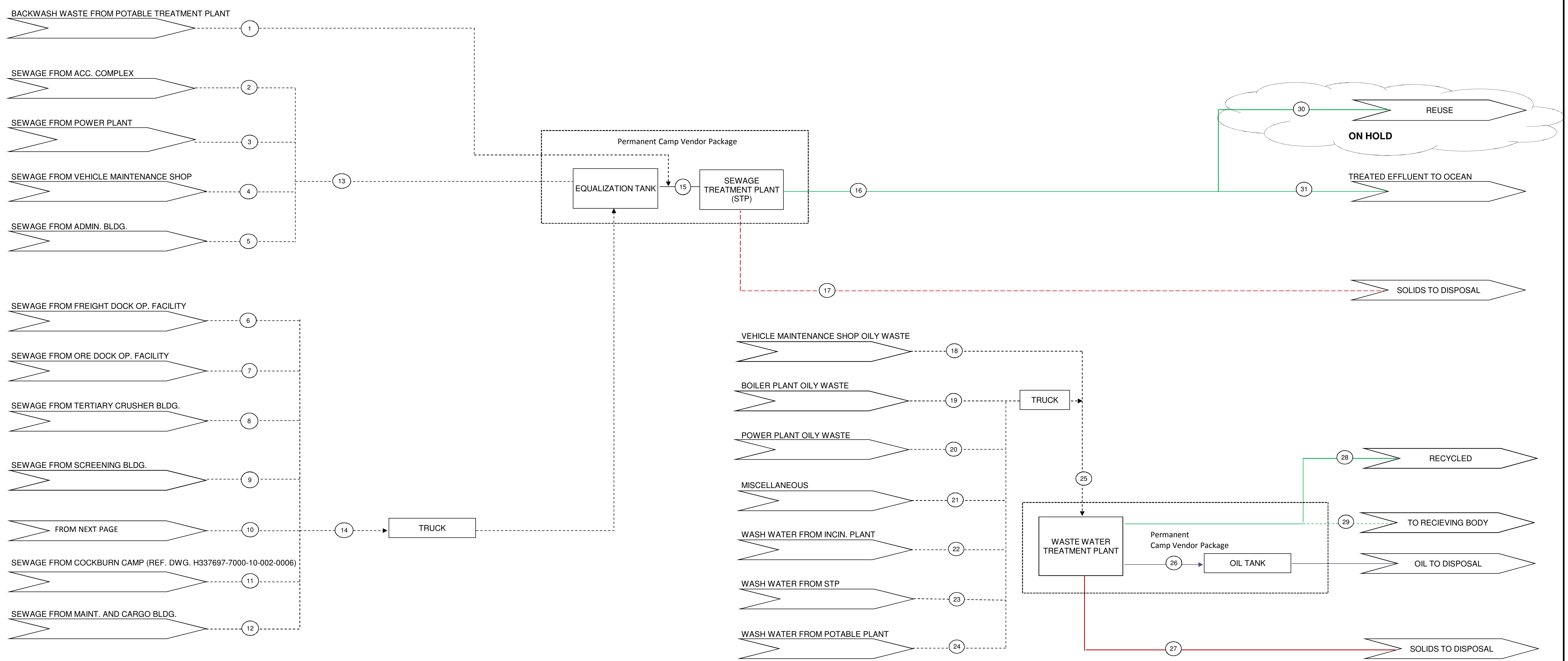
PROJ. ENGR. J. CASSON Date: 12/21/2011
PROJECT MANAGER H. CHARALAMBU Date: 12/21/2011

STEENSBY - MARY RIVER PROJECT
BLOCK FLOW DIAGRAM
PERMANENT CAMP - WATER SUPPLY BALANCE

Drawing No. H337697-4510-10-002-0001
SHEET 3 OF 5
Rev. F



NOTES:

1) The peak flows from the accommodation facilities were determined using a peaking factor.
2) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
3) Sewage will be drained from a local collection tank at each remote location
4) Effluent reuse is optional. To be reviewed in detailed engineering.
5) Miscellaneous refers to potential oily water flow from the bermed tank farm areas and fuel refilling station run-off only if sampling indicates that additional treatment of this run-off is necessary.
6) The explosives plant will come complete with it's own evaporation system such that no liquid waste will be generated.

Stream No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stream Description	BACKWASH WASTE FROM PWTP	SEWAGE FROM ACC. COMPLEX	SEWAGE FROM POWER PLANT	SEWAGE FROM VEHICLE MAINTENACE SHOP	SEWAGE FROM ADMIN. BLDG.	SEWAGE FROM FREIGHT DOCK OP.	SEWAGE FROM ORE DOCK OP.	SEWAG E FROM TERTIARY CRUSHER BLDG.	SEWAGE FROM SCREENING BLDG.	FROM NEXT PAGE	SEWAGE FROM COCKBURN SOUTH	SEWAGE FROM MAINT. & CARGO BLDG.	PIPED SEWAGE	TRUCKED SEWAGE	FEED TO STP
Construction Phase - Design (m^3/h)	0.003	22.3	0.0	3.8	3.8	42.9	42.9	42.9	42.9	42.9	42.9	42.9	30.0	42.9	17.5
Construction Phase - Nominal (m^3/h)	0.002	2.5	0.0	1.5	1.3	0.19	0.19	0.05	0.05	0.67	7.50	0.03	5.33	8.67	14.00
Operation Phase - Design (m^3/h)	0.003	20.4	0.5	1.9	1.4	42.9	42.9	42.9	42.9	42.9	0.00	42.9	24.2	42.9	3.8
Operation Phase - Nominal (m^3/h)	0.002	1.6	0.1	0.7	0.4	0.04	0.04	0.05	0.05	0.00	0.00	0.00	2.82	0.18	3.00

Stream No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Stream Description	STP EFFLUENT	SOLIDS TO DISPOSAL	VEHICHLE MAINT. SHOP OILY WASTE	BOILER PLANT OILY WASTE	POWER PLANT OILY WASTE	MISCELLANE OUS	WASH WATER FROM INCIN. PLANT	WASH WATER FROM STP.	WASH WATER FROM PWTP	TOTAL FEED TO WWTP	OILY WASTE	OILY SOLIDS TO DISPOSAL	RECYCLED WWTP EFFLUENT	WWTP EFFLUENT TO OCEAN	REUSE	STP EFFLUENT TO OCEAN
Construction Phase - Design (m^3/h)	17.4	0.1	-	42.9	42.9	42.9	42.9	42.9	42.86	42.86	0.0004	n/a	0.2	0.05	42.9	17.4
Construction Phase - Nominal (m^3/h)	13.9	0.1	-	0.01	0.1	0.01	0.04	0.04	0.01	0.25	0.0004	0.04	0.2	0.04	2.5	11.3
Operation Phase - Design (m^3/h)	3.7	0.03	11.0	42.9	42.9	42.9	42.9	42.9	42.86	42.86	0.0015	n/a	0.9	0.23	42.9	3.7
Operation Phase - Nominal (m^3/h)	3.0	0.02	0.65	0.01	0.1	0.1	0.04	0.0	0.01	0.96	0.0015	0.04	0.7	0.18	-	3.0

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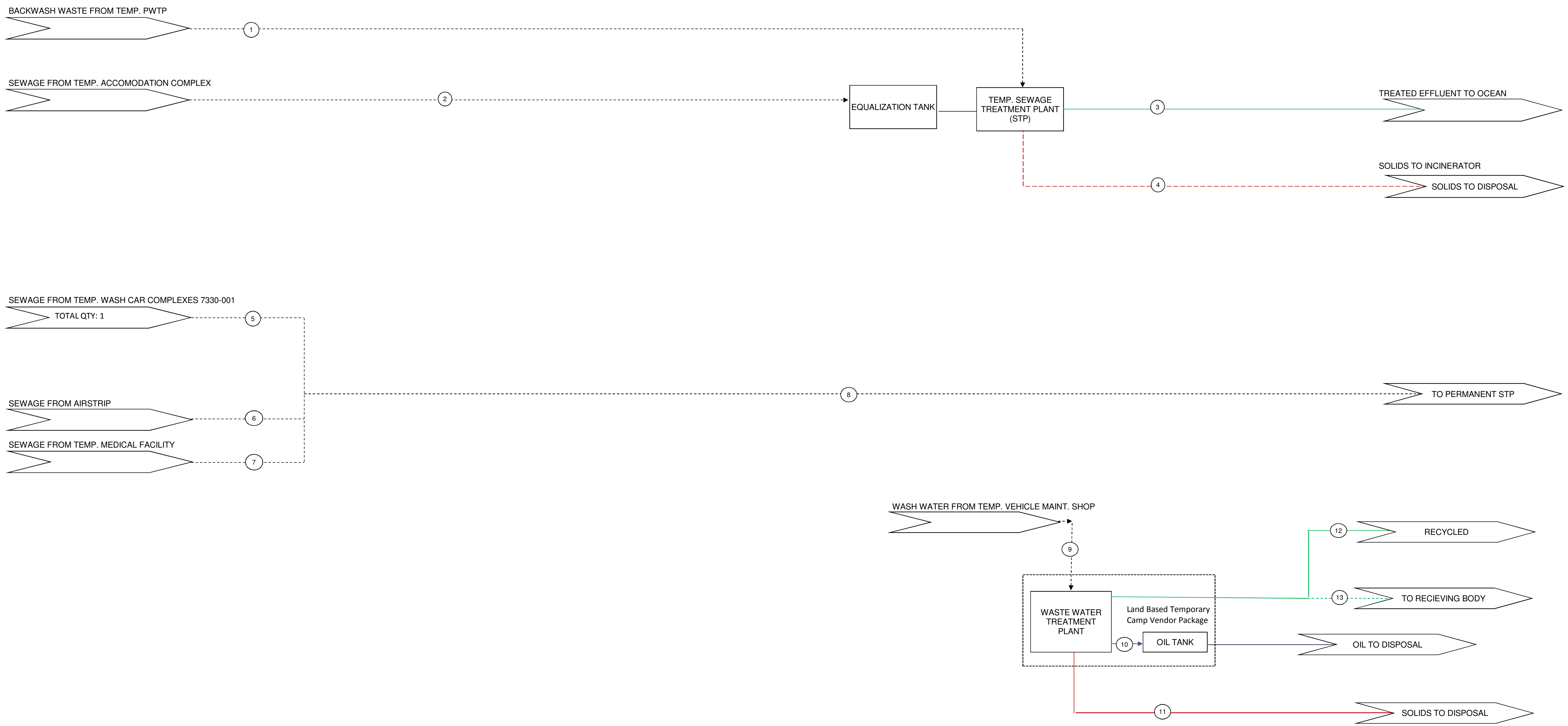
DESIGNED BY R. KAPADIA Date: 12/21/2011	DRAWN BY R. KAPADIA Date: 12/21/2011	**STEENSBY - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **PERMANENT CAMP - WASTE WATER BALANCE**
CHECKED BY R. RADAKOVIC Date: 12/21/2011	DISCIP ENGR. R. KAPADIA Date: 12/21/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/21/2011	
PROJECT MANAGER H. CHARALAMBU Date: 12/21/2011	Drawing No. H337697-4510-10-002-0001 SHEET 4 of 5	Rev. F



NOTES:

1) The peak flows from the accommodation facilities were determined using a peaking factor.

2) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.

3) Sewage will be drained from a local collection tank at each remote location

4) Effluent reuse is optional. To be reviewed in detailed engineering.

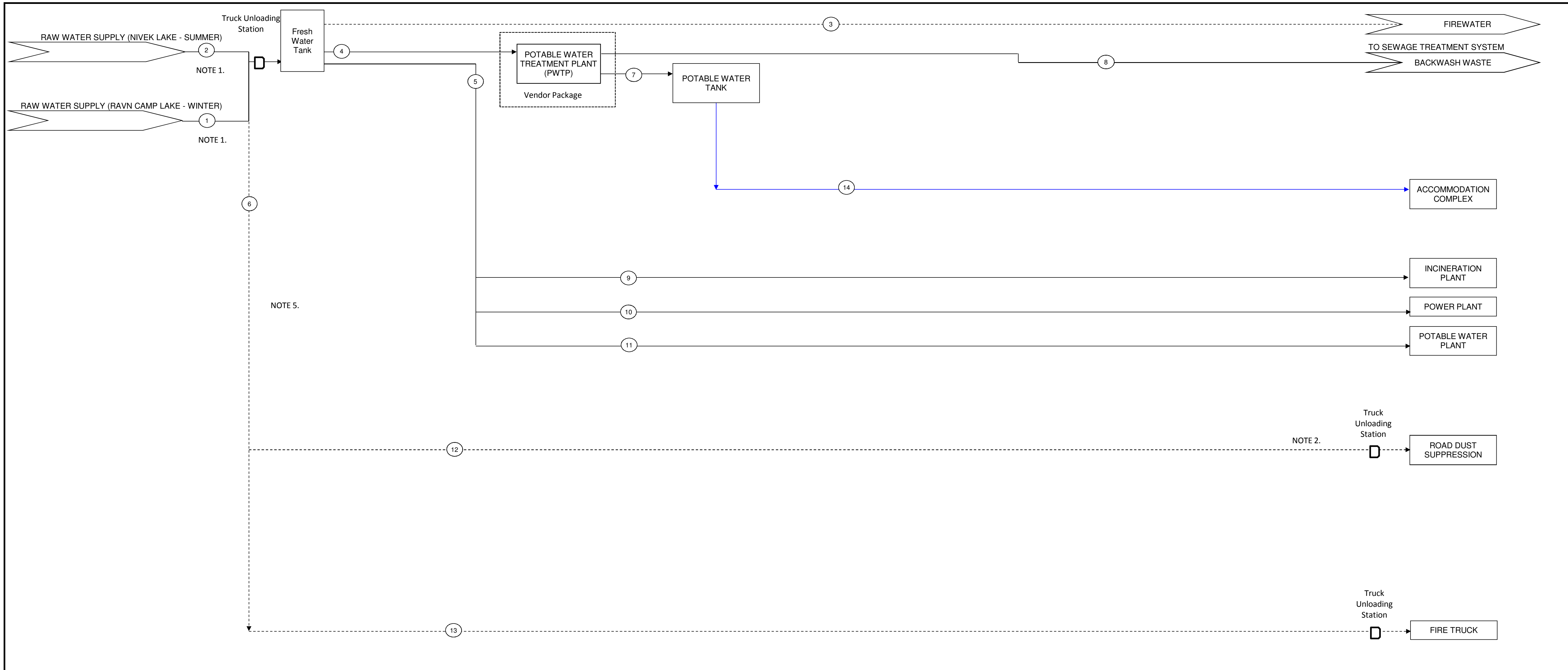
Stream No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Stream Description	WASTE FROM TEMP. PWTP	SEWAGE FROM TEMP. ACC. COMPLEX	TEMP. STP EFFLUENT	TEMP. STP SOLIDS	SEWAGE FROM TEMP. CAR WASH	SEWAGE FROM AIRSTRIP	SEWAGE FROM TEMP. MEDICAL FACILITY	TRUCKED SEWAGE TO STP	WATER FROM TEMP. VEHICLE SHOP	OIL WASTE	WWTP SOLIDS WASTE	RECYCLED EFFLUENT	WWTP EFFLUENT TO OCEAN
Construction Phase - Design (m^3/h)	0.003	27.0	27.0	0.04	42.9	42.9	42.9	42.86	42.86	0.00	n/a	1.18	-
Construction Phase - Nominal (m^3/h)	0.002	4.5	4.46	0.04	0.1	0.05	0.5	0.6740	1.1426	0.0018	0.2000	0.9408	-
Operation Phase - Design (m^3/h)	0.000	0.0	0.0	0.00	-	42.9	-	42.9	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	0.000	0.0	0.0	0.00	-	0.001	-	0.001	-	-	-	-	-

DESIGNED BY R. KAPADIA Date: 12/21/2011	DRAWN BY R. KAPADIA Date: 12/21/2011
CHECKED BY R. RADAKOVIC Date: 12/21/2011	DISCIP ENGR. R. KAPADIA Date: 12/21/2011
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/21/2011
PROJECT MANAGER H. CHARALAMBU Date: 12/21/2011	

STEENSBY - MARY RIVER PROJECT
BLOCK FLOW DIAGRAM
TEMPORARY CAMP - WASTE WATER BALANCE

Drawing No.
H337697-4510-10-002-0001
SHEET 5 of 5

Rev.
F



NOTES:

1) The system will have a different raw water source for winter from summer. As such the flows for these two streams are indicative of the summer or winter period only.
2) The flows for these streams will occur in the summer time only.
3) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
4) The peak flows for the accommodation facilities were determined using a peaking factor.
5) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
6) Potable water will be supplied from the accommodation complex to the STP, Incineration Plant, Power Plant and PWTP using bottles.

LEGEND:
——— CONTINUOUS FLOW.
- - - - - INTERMITTENT FLOW.

Stream No.	1	2	3	4	5	6	7
Stream Description	WINTER RAW WATER SUPPLY	SUMMER RAW WATER SUPPLY	FIREWATER	FEED TO POTABLE TREATMENT SYSTEM	PIPED FRESH WATER	TRUCKED FRESH WATER	POTABLE SYSTEM PRODUCT FLOW
Construction Phase - Design (m^3/h)	42.9	42.9	300.0	2.8	10.2	42.9	2.8
Construction Phase - Nominal (m^3/h)	3.3	3.3	-	2.8	0.4	0.1	2.8
Operation Phase - Design (m^3/h)	-	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-	-
Stream No.	8	9	10	11	12	13	14
Stream Description	POTABLE SYSTEM WASTE FLOW	WASH WATER TO INCIN. PLANT	WASH WATER TO POWER PLANT	WASH WATER TO PWTP	ROAD DUST SUPPRESS	FIRETRUCK WATER	POTABLE WATER TO ACC. COMPLEX
Construction Phase - Design (m^3/h)	0.002	3.4	3.4	3.4	42.9	42.9	21.3
Construction Phase - Nominal (m^3/h)	0.001	0.1	0.1	0.1	0.1	-	2.8
Operation Phase - Design (m^3/h)	-	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-	-

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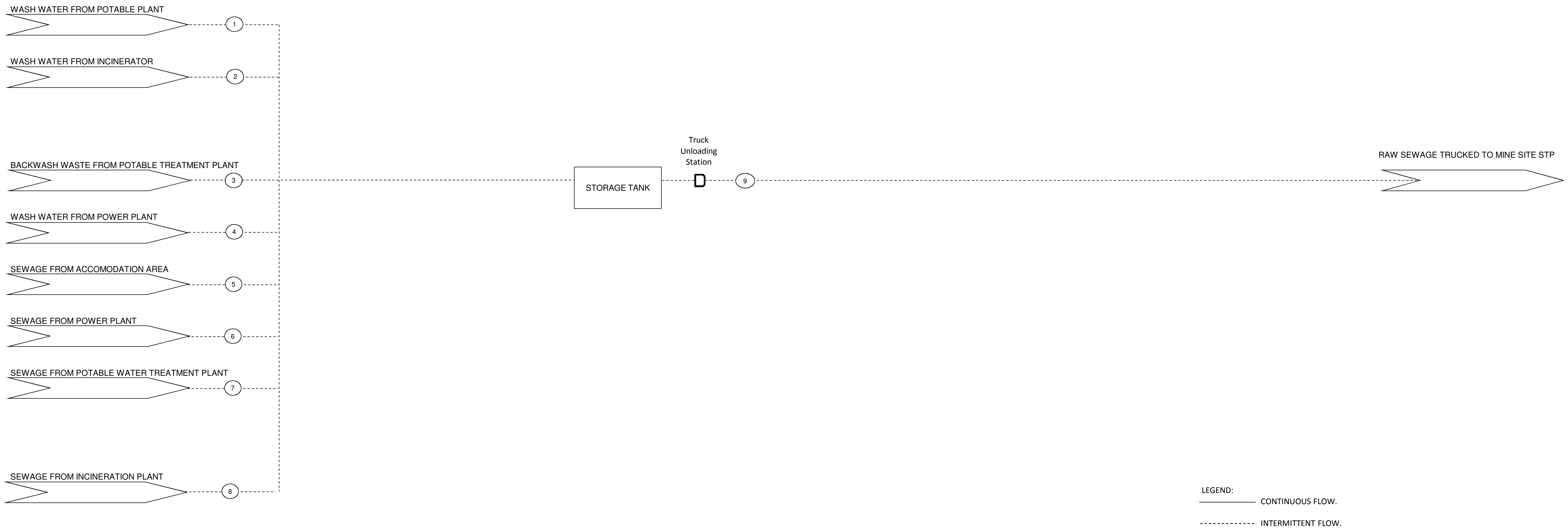
DESIGNED BY R. KAPADIA Date: 8/22/2011	DRAWN BY R. KAPADIA Date: 8/22/2011	**MID-RAIL CAMP - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **WATER SUPPLY BALANCE**
CHECKED BY A. ZLATIC Date: 8/22/2011	DISCIP ENGR. A. ZLATIC Date: 8/22/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 8/22/2011	
PROJECT MANAGER H. CHARALAMBU Date: 8/22/2011	Drawing No. H337697-7000-10-002-0004 SHEET 1 OF 2	Rev. E



NOTES:

1) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
2) The peak flows for the accommodation facilities were determined using a peaking factor.
3) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
4) It has been assumed that relative sewage flows will be distributed through different facilities in the same proportions as the relative potable water flows.

Stream No.	1	2	3	4
Stream Description	WASH WATER FROM POTABLE PLANT	WASH WATER FROM INCIN.	PWTP BACKWASH WASTE STREAM	WASH WATER FROM POWER PLANT
Construction Phase - Design (m^3/h)	3.4	3.4	0.002	3.407
Construction Phase - Nominal (m^3/h)	0.1	0.1	0.001	0.142
Operation Phase - Design (m^3/h)	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-

Stream No.	5	6	7	8	9
Stream Description	SEWAGE FROM ACC. COMPLEX	SEWAGE FROM POWER PLANT	SEWAGE FROM PWTP	SEWAGE FROM INCIN. PLANT	RAW SEWAGE TO MINE SITE STP
Construction Phase - Design (m^3/h)	24.40	0.02	0.02	0.01	42.9
Construction Phase - Nominal (m^3/h)	2.39	0.02	0.02	0.01	2.9
Operation Phase - Design (m^3/h)	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-

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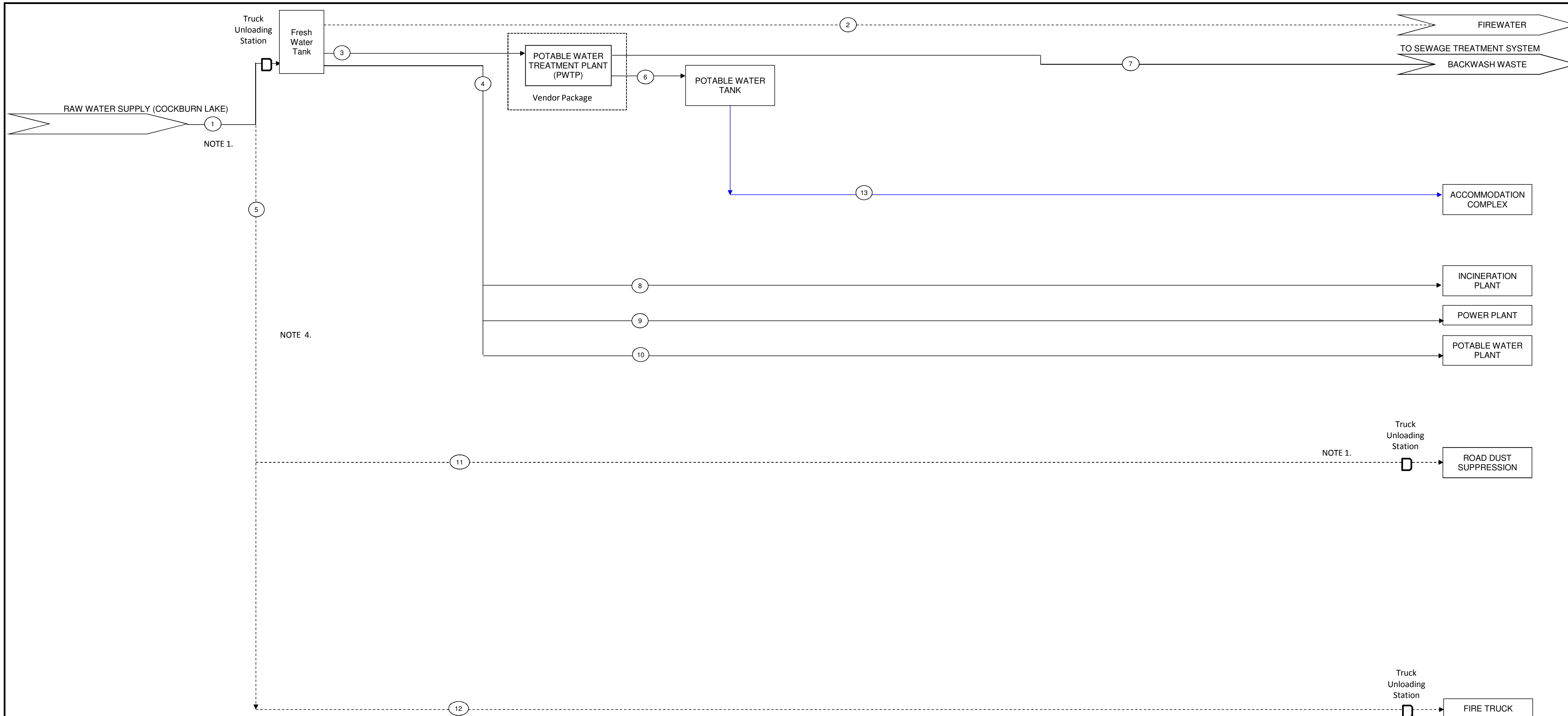
DESIGNED BY R. KAPADIA Date: 8/22/2011	DRAWN BY R. KAPADIA Date: 8/22/2011	**MID-RAIL CAMP - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **WASTE WATER BALANCE**
CHECKED BY A. ZLATIC Date: 8/22/2011	DISCIP ENGR. A. ZLATIC Date: 8/22/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 8/22/2011	
PROJECT MANAGER H. CHARALAMBU Date: 8/22/2011	Drawing No. H337697-7000-10-002-0004 SHEET 2 OF 2	Rev. E



NOTES:

1) The flows for these streams will occur in the summer time only.
2) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
3) The peak flows for the accommodation facilities were determined using a peaking factor.
4) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
5) Potable water will be supplied from the accommodation complex to the STP, Incineration Plant, Power Plant and PWTP using bottles.

LEGEND:

—— CONTINUOUS FLOW.

- - - - INTERMITTENT FLOW.

Stream No.	1	2	3	4	5	6
Stream Description	RAW WATER SUPPLY	FIREWATER	FEED TO POTABLE TREATMENT SYSTEM	PIPED FRESH WATER	TRUCKED FRESH WATER	POTABLE SYSTEM PRODUCT FLOW
Construction Phase - Design (m^3/h)	42.9	300.0	4.1	10.2	42.9	4.1
Construction Phase - Nominal (m^3/h)	4.7	0.0	4.1	0.4	0.1	4.1
Operation Phase - Design (m^3/h)	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-

Stream No.	7	8	9	10	11	12	13
Stream Description	POTABLE SYSTEM WASTE FLOW	WASH WATER TO INCIN. PLANT	WASH WATER TO POWER PLANT	WASH WATER TO PWTP	FRESHWATER TRUCK	FIRETRUCK WATER	POTABLE WATER TO ACC. COMPLEX
Construction Phase - Design (m^3/h)	0.0	3.4	3.4	3.4	42.9	42.9	23.3
Construction Phase - Nominal (m^3/h)	0.0	0.1	0.1	0.1	0.1	0.0	4.1
Operation Phase - Design (m^3/h)	-	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-	-

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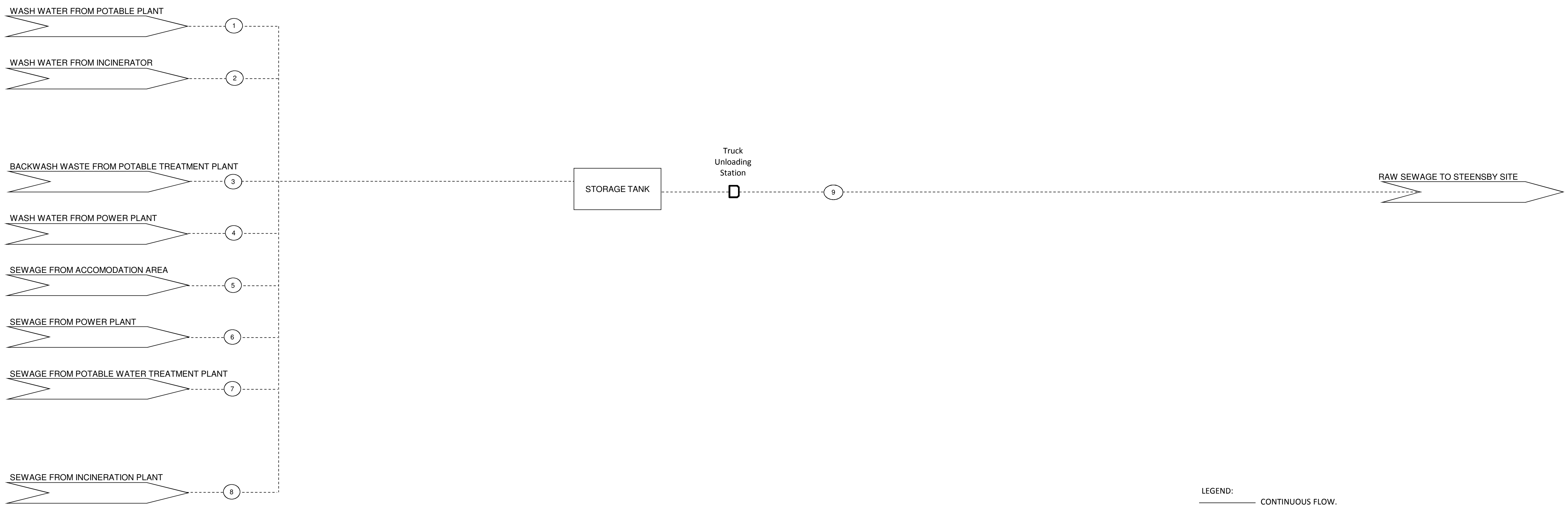
DESIGNED BY R. KAPADIA Date: 11/10/2011	DRAWN BY R. KAPADIA Date: 11/10/2011	**COCKBURN SOUTH CAMP - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **WATER SUPPLY BALANCE**
CHECKED BY R. RADAKOVIC Date: 11/10/2011	DISCIP ENGR. R. KAPADIA Date: 11/10/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 11/10/2011	
PROJECT MANAGER H. CHARALAMBU Date: 11/10/2011	Drawing No. H337697-7000-10-002-0006 SHEET 1 OF 2	Rev. E



LEGEND:

——— CONTINUOUS FLOW.

- - - - - INTERMITTENT FLOW.

NOTES:

1) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
2) The peak flows for the accommodation facilities were determined using a peaking factor.
3) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
4) It has been assumed that relative sewage flows will be distributed through different facilities in the same proportions as the relative potable water flows.
5) Effluent reuse is optional. To be reviewed in detailed engineering.

Stream No.	1	2	3	4
Stream Description	WASH WATER FROM POTABLE PLANT	WASH WATER FROM INCIN.	PWTP BACKWASH WASTE STREAM	WASH WATER FROM POWER PLANT
Construction Phase - Design (m^3/h)	3.4	3.4	0.001	3.4
Construction Phase - Nominal (m^3/h)	0.1	0.1	0.001	0.1
Operation Phase - Design (m^3/h)	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-

Stream No.	5	6	7	8	9
Stream Description	SEWAGE FROM ACC. COMPLEX	SEWAGE FROM POWER PLANT	SEWAGE FROM PWTP	SEWAGE FROM INCIN. PLANT	RAW SEWAGE TO STEENSBY
Construction Phase - Design (m^3/h)	26.70	0.04	0.04	0.02	42.9
Construction Phase - Nominal (m^3/h)	3.78	0.04	0.04	0.02	4.3
Operation Phase - Design (m^3/h)	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-

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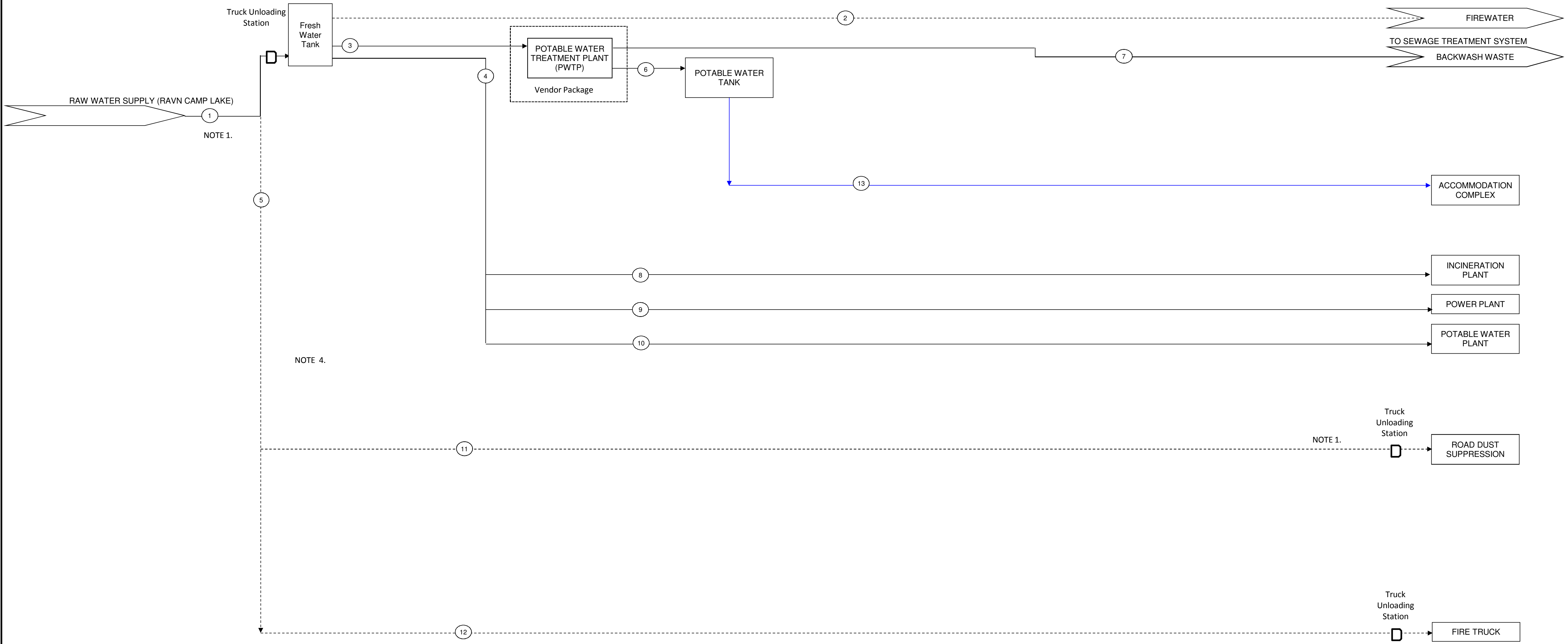
DESIGNED BY R. KAPADIA Date: 11/10/2011	DRAWN BY R. KAPADIA Date: 11/10/2011	**COCKBURN SOUTH TUNNELS CAMP - MARY RIVER PROJECT BLOCK FLOW DIAGRAM WASTE WATER BALANCE**
CHECKED BY R. RADAKOVIC Date: 11/10/2011	DISCIP ENGR. R. KAPADIA Date: 11/10/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 11/10/2011	
PROJECT MANAGER H. CHARALAMBU Date: 11/10/2011		Drawing No. H337697-7000-10-002-0006 SHEET 2 OF 2 Rev. E



NOTES:

1) The flows for these streams will occur in the summer time only.
2) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
3) The peak flows for the accommodation facilities were determined using a peaking factor.
4) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
5) Potable water will be supplied from the accommodation complex to the STP, Incineration Plant, Power Plant and PWTP using bottles.

LEGEND:

———— CONTINUOUS FLOW.

- - - - - - INTERMITTENT FLOW.

Stream No.	1	2	3	4	5	6
Stream Description	RAW WATER SUPPLY	FIREWATER	FEED TO POTABLE TREATMENT SYSTEM	PIPED FRESH WATER	TRUCKED FRESH WATER	POTABLE SYSTEM PRODUCT FLOW
Construction Phase - Design (m^3/h)	42.9	300.0	5.5	10.2	42.9	5.5
Construction Phase - Nominal (m^3/h)	6.1	-	5.5	0.4	0.1	5.5
Operation Phase - Design (m^3/h)	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-

Stream No.	7	8	9	10	11	12	13
Stream Description	POTABLE SYSTEM WASTE FLOW	WASH WATER TO INCIN. PLANT	WASH WATER TO POWER PLANT	WASH WATER TO PWTP	ROAD DUST SUPPRESS	FIRETRUCK WATER	POTABLE WATER TO ACC. COMPLEX
Construction Phase - Design (m^3/h)	0.002	3.4	3.4	3.4	42.9	42.9	31.1
Construction Phase - Nominal (m^3/h)	0.001	0.1	0.1	0.1	0.1	-	5.5
Operation Phase - Design (m^3/h)	-	-	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-	-	-

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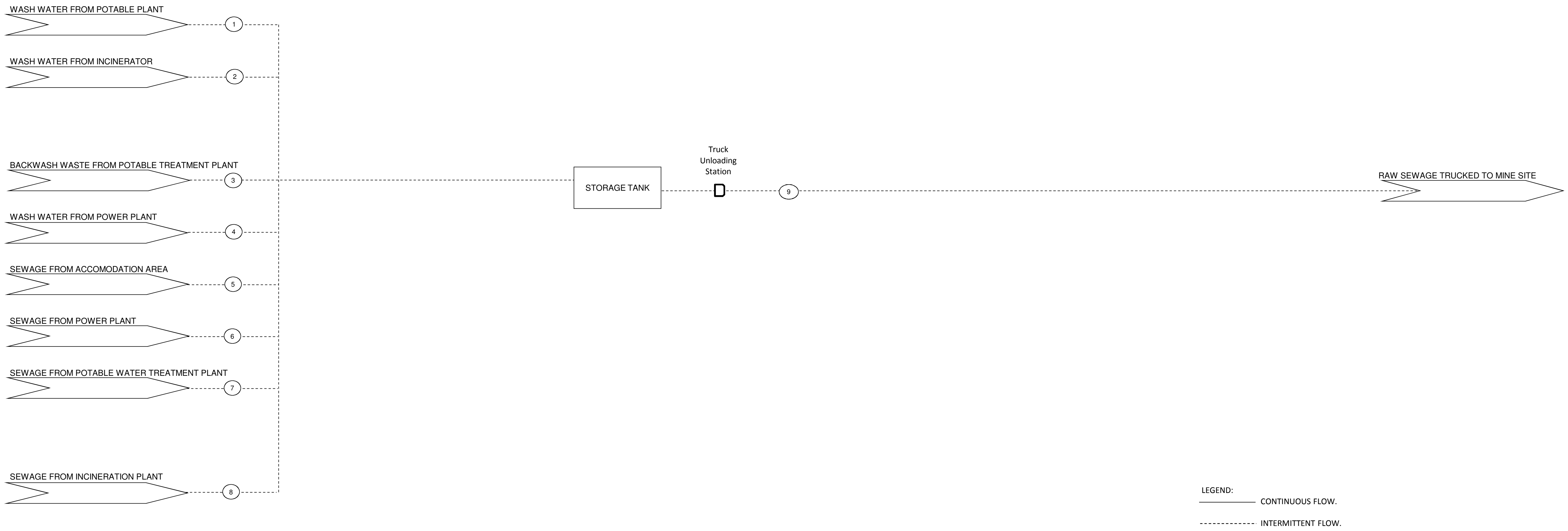
DESIGNED BY R. KAPADIA Date: 11/10/2011	DRAWN BY R. KAPADIA Date: 11/10/2011	**RAVN RIVER CAMP - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **WATER SUPPLY BALANCE**
CHECKED BY R. RADAKOVIC Date: 11/10/2011	DISCIP ENGR. R. KAPADIA Date: 11/10/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 11/10/2011	
PROJECT MANAGER H. CHARALAMBU Date: 11/10/2011	Drawing No. H337697-7000-10-002-0003 SHEET 1 OF 2	Rev. E



NOTES:

1) The flow values on this water balance have been derived from previous consultants documentation produced during the earlier phase of the project. Where values were missing Hatch estimations are used.
2) The peak flows for the accommodation facilities were determined using a peaking factor.
3) The division of trucked and piped facilities is based upon the proximity of the various facilities as indicated on layouts prepared by Hatch.
4) It has been assumed that relative sewage flows will be distributed through different facilities in the same proportions as the relative potable water flows.

Stream No.	1	2	3	4
Stream Description	WASH WATER FROM POTABLE PLANT	WASH WATER FROM INCIN.	PWTP BACKWASH WASTE STREAM	WASH WATER FROM POWER PLANT
Construction Phase - Design (m^3/h)	3.4	3.4	0.0017	3.4
Construction Phase - Nominal (m^3/h)	0.1	0.1	0.0014	0.1
Operation Phase - Design (m^3/h)	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-

Stream No.	5	6	7	8	9
Stream Description	SEWAGE FROM ACC. COMPLEX	SEWAGE FROM POWER PLANT	SEWAGE FROM PWTP	SEWAGE FROM INCIN. PLANT	RAW SEWAGE TO MINE SITE
Construction Phase - Design (m^3/h)	35.60	0.05	0.05	0.03	42.9
Construction Phase - Nominal (m^3/h)	5.76	0.05	0.05	0.03	6.3
Operation Phase - Design (m^3/h)	-	-	-	-	-
Operation Phase - Nominal (m^3/h)	-	-	-	-	-

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DESIGNED BY R. KAPADIA Date: 11/10/2011	DRAWN BY R. KAPADIA Date: 11/10/2011	**RAVN RIVER CAMP - MARY RIVER PROJECT** **BLOCK FLOW DIAGRAM** **WASTE WATER BALANCE**
CHECKED BY R. RADAKOVIC Date: 11/10/2011	DISCIP ENGR. R. KAPADIA Date: 11/10/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 11/10/2011	
PROJECT MANAGER H. CHARALAMBU Date: 11/10/2011		Drawing No. H337697-7000-10-002-0003 SHEET 2 OF 2 — Rev. E

Appendix F -
Polishing Waste Stabilization Ponds (PWSP) Effluent Discharge Plan

Technical Memorandum

To: Jim Millard, Baffinland Iron Mines

From: Dave Ellis, P.Eng., AMEC
Jered Munro, AMEC

Date: March 27, 2012

PROFESSIONAL ENGINEER REGISTERED D.D.J. ELLIS LICENSEE Mar 27/12 NT/NU

Subject: PWSP Effluent Discharge Plan

Baffinland Iron Mines Corporation (BIM) has retained AMEC Environment & Infrastructure (AMEC) to prepare this plan for the management, treatment, and disposal of the wastewater stored in the polishing/ waste stabilization ponds (PWSPs) at the Milne Inlet and Mary River facilities.

This plan updates the previous plan presented March 2010. To the extent possible, the discharge plans and options presented herein are flexible with a view to accommodating various seasonal operating requirements.

AMEC was retained by BIM in 2009 to develop and design a polishing treatment system for treating the effluent from the Mary River sanitary treatment system stored in the three PWSPs at that site. This memorandum identifies the following:

- the design criteria,
- overall discharge approach,
- the polishing system treatment components and functionality, and
- the sampling and performance monitoring plan.

This PWSP effluent discharge plan remains largely unchanged from the 2009 plan.

POLISHING SYSTEM DESIGN CRITERIA

Discharge Quality

The design criteria for the effluent discharge quality are defined in the water licence issued by the Nunavut Water Board, Licence 2BB-MRY1114 dated April 5, 2011 and are summarized below:

Table 1: Discharge Criteria of PWSP Effluent

Parameter	Discharge Criteria (Maximum Concentration of any Grab Sample)	
Location	**Mary River WWTF**	**Milne Inlet WWTF**
BOD_5	30 mg/ L	100 mg/L
TSS	35 mg/L	120 mg/ L
Faecal Coliform	1,000 CFU/100mL	10,000 CFU/100mL
Oil and Grease	No visible sheen	No visible sheen
pH	Between 6.0 and 9.5	Between 6.0 and 9.5
Toxicity	Final effluent not acutely toxic	Final effluent not acutely toxic
Ammonia[1]	N/A	N/A
Total Phosphorus[2]	0.5 – 1.0 mg/L	N/A

AMEC Environment & Infrastructure
A division of AMEC Americas Limited
900 Maple Grove Road, Unit 10
Cambridge, ON N3H 4R7
Tel 519-650-7100
Fax 519-653-6554

Notes: 1. No specific criteria for ammonia, but effluent must be acutely non-toxic.
2. The range set for total phosphorus discharge target levels to Sheardown Lake were set based on results of the mass loading model developed by North South Consultants.

The phosphorus limit was confirmed to not be detrimental to the receiving aquatic environment by North/South Consultants, who employed modelling software to predict the effects of the effluent discharge based on the maximum design parameters listed in Table 1.

Following Part I, Items 4 and 5, the water licence requires sampling of the effluent from the PWSPs to be completed once prior to discharge, and every four weeks thereafter, for the following parameters:

- Biochemical oxygen demand (BOD),
- Total suspended solids,
- pH,
- Faecal coliform, and
- Oil and grease (visual).

Toxicity testing on treated effluent is required to be completed once annually during open water season at the final discharge point in accordance with the following tests:

- Acute lethality to Rainbow Trout (Oncorhynchus mykiss) as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13.
- Acute lethality to Daphnia magna as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14.

The discharge criteria remain largely unchanged from the previous licence 2BB-MRY0710 with the notable exception that the current licence specifies the compliance parameters in terms of "maximum concentration of any grab sample" as compared to the previous licence which listed compliance parameters as "maximum average" concentrations.

Discharge Flow

The design polishing system flow rate was originally determined based on a desired operating schedule of 24 hours per day, 7 days per week, for a duration of 3 weeks. The combined storage volume contained in the Mary River PWSPs No. 2 and 3 was estimated at approximately 6 million liters (~1.5 MUSG).

The flow rate of 375 L/min (100 USgpm) was set as the nominal design flow rate for the polishing system. This design flow rate was used to select the required chemical dosing equipment and was used for initial planning purposes based on an assumed 75% uptime rate and a discharge of 75% of the design flow rate.

The effluent discharge pipe to Sheardown Lake is a 3" diameter, HDPE pipe that is approximately 1.5 km long. To achieve the 100 USgpm design flow rate through the long discharge pipe requires considerable discharge pressure be developed at the pump discharge. Practical limitations in operating gas-powered centrifugal pumps in series have prevented the planned flow rate from being achieved.

The Milne PWSP is estimated to hold approximately 0.5 million litre (approximately 130,000 USgals) of combined RBC sludge, grey water, and snow melt.

OVERALL PWSP DISCHARGE APPROACH

Once the water in the PWSPs begins to thaw in late May, a sample from each of the PWSPs is submitted for analysis of the regulated effluent criteria parameters. Depending on the water quality confirmed in the respective PWSP, discharge may commence, as detailed below.

Option #1—Spring Discharge

If the PWSP melt water sample is in compliance with the regulated criteria, Baffinland will commence discharge of the compliant effluent.

Once discharge has commenced, Baffinland will field test for pH, and turbidity and complete confirmatory sampling using bench-top screening methods to monitor the effluent quality. Discharge will be discontinued following established Standard Operating Procedures (SOPs) if any of the tests approach effluent criteria limits.

Sheardown Lake remains ice covered during the Spring Discharge. This ice cover requires a hole be augered through the ice and a temporary discharge pipe installed. The temporary discharge pipe conducts the effluent to a point below the ice to prevent erosion or sediment entrainment due to the discharge flow. At the completion of the Spring Discharge the temporary pipe is removed from Sheardown.

The quality of the water in the Milne PWSP has typically been such that the spring melt water has been compliant with the criteria without further polishing treatment.

Option #2—Summer Polishing Treatment and Discharge

If the water quality in the PWSPs does not meet all effluent discharge criteria, then the effluent would be treated using all or part of the polishing treatment system, depending on the particular parameters of concern. During the start-up of the polishing treatment system, the effluent is discharged back into a PWSP. The treated effluent would not be discharged until laboratory analytical results confirmed that the polishing treatment system was producing compliant effluent.

Following confirmation of effluent quality, the polishing system is operated and the treated water discharged to Sheardown Lake until the PWSPs have been emptied or weather conditions become unfavourable for treatment.

Should the Milne PWSP water require further polishing treatment, it can be transferred to Mary River for treatment and discharge through the Mary River PWSP system.

POLISHING TREATMENT SYSTEM COMPONENTS AND FUNCTIONALITY

The polishing treatment system was designed to provide additional treatment for total suspended solids (TSS) and total phosphorus (TP) removal, as well as pH control.

The polishing system contains the following unit processes, as shown in the attached Process Flow Diagram, PFD-01 (Attachment A) and the attached photographs (Attachment B). A more detailed description and photographs are included in the system Operation and Maintenance Manual.

Influent Pump and Flow Meter

A pump draws from one of the ponds and feeds water at a design flow of 100 USgpm. A flow meter with totalizer is used to monitor this influent flow. Flow to the polishing system can be controlled by throttling the influent pump speed or by adjusting a 3-inch ball-valve that bleeds water back into the pond.

Chemical Addition

Water treatment chemicals were added to the influent water to aid in the treatment process. The following chemicals were used in the 2009 and 2011 polishing system:

- Aluminum sulphate (commonly called “alum”), and
- A polymer, marked “Polyfloc AP1138” by the manufacturer, GE Betz Inc.

Aluminum Sulphate (Alum) Addition

Aluminum sulphate is added to achieve three goals:

- Precipitation of soluble phosphorous to a solid,
- Coagulation of algae and other suspended solids, and
- Reduction of pH.

Alum is dosed into the influent pipe by means of a chemical metering pump and then mixed in the flocculator piping to promote precipitation and coagulation chemical reactions and achieve flocc formation.

Polymer Addition

Polymer is added, after the alum, to further enhance the formation of larger solids allowing them to separate more quickly from the bulk liquid once in the DAF tank. The polymer serves as a flocculant which promotes the agglomeration of smaller coagulated solids into larger flocs. These larger flocs are more readily removed by downstream processes.

Polymer is added in a similar fashion as the aluminum sulphate, with mixing in the flocculator piping before entrance into the DAF.

Dissolved Air Flotation (DAF) System

Water containing alum and polymer is combined with a recirculating stream of water which is supersaturated with dissolved air. As the dissolved air comes out of solution, microscopic air bubbles are formed on the flocculated solids, thus increasing their buoyancy. These buoyant solids float to the surface and can be easily skimmed off.

Air Dissolving Pump

The dissolved air flotation (DAF) system is comprised of a number of components. The heart of the system is a Hellbender-brand air dissolving pump. This pump is specifically designed to accept large amounts of air mixed with water, and operates under high pressure to dissolve and shear the air into fine micro bubbles. When the high pressure, air-rich, stream meets the lower pressure flocculated influent water, dissolved air comes out of solution forming small air bubbles. These small bubbles attach to the flocculated solids causing them to rise to the surface once inside the DAF tank.

DAF Tank

Influent water that has already been combined with the air-rich recirculation water is distributed across the width of the rectangular DAF tank through a relatively large, 6-inch diameter distribution header. This large inlet header is used to minimize water entrance velocity and facilitate a quiescence of the water in the tank.

These quiescent conditions in the DAF tank allow the buoyant solids to float to the surface. Solids are periodically skimmed off the top of the tank, over a collection beach, into a sludge trough. The sludge trough discharges collected solids by gravity to two large totes for disposal.

At the opposite end of the DAF tank from the inlet is the outlet. Clarified water is collected through a 4-inch diameter effluent header located halfway up the height of the tank. The clarified water is directed to the final effluent clear-well tanks.

Floated Solids Storage and Pumping

Two parallel solids holding tanks have been provided to capture the floated solids. A pump is used to pump the float solids into PWSP No. 1 for storage.

Final pH Adjustment

Two effluent clear-well tanks are connected in series so that the water can be pH adjusted with sodium bicarbonate, if needed.

Final Filtration

If desired, the effluent can be passed through a final filtration process prior to discharge.

Effluent Pumping and Flow Monitoring

Clarified water is pumped through Tsurumi brand trash pumps, that discharge into the 3-inch Sheardown discharge pipeline. The treated water discharge flow is measured using a flowmeter with totalizer.

SAMPLING AND PERFORMANCE MONITORING

During operation, the treatment system is attended on a continuous basis. Samples of the daily field logs are attached (Attachment C). Attachment C.1 is the daily field log used during the spring discharge, when there is little or no treatment of the PWSP water required. Attachment C.2 is used when the full polishing system is required as may be necessary during late summer.

The polishing system is controlled using field testing devices for pH and turbidity measurement. Adjustments were made to the aluminum sulphate and sodium bicarbonate dosing pumps to control the pH and the polymer dosing pump was used to control the turbidity (indicative of total suspended solids-TSS). Physical inspection of the DAF inlet and discharge streams, as well as the consistency of the floated solids layer, indicated to the operators how well the system was operating. In the event of a suspect test result, a bypass valve is used to redirect effluent back to the PWSP while the system operation was adjusted and retested.

A summary of the PWSP external lab and in-house analysis program can be found in tables (2) and (3).

Table 1 – On-site lab analysis parameters and schedule.

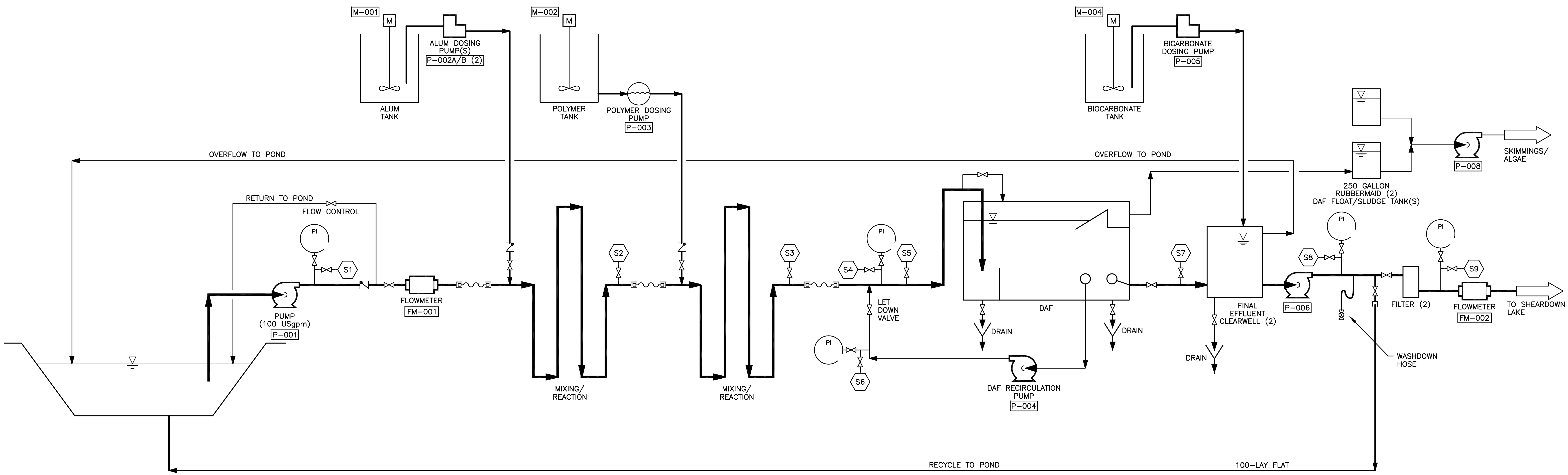
In House Analysis	Daily (onsite lab)	Hourly (in field)
pH	✓	✓
Temperature	✓	✓
Turbidity	✓	✓
TP	✓	
Ammonia	✓	
COD	✓	

Table 2 – External lab analysis parameters and schedule.

External Lab Analysis	Pre Discharge	Middle of Discharge	Every Week
BOD	✓		✓
COD	✓		✓
TSS	✓		✓
TP	✓		✓
Fecal Coliforms	✓		✓
Toxicity	✓	✓	
O&G	✓		✓

Attachment A

PWSP Polishing System Process Flow Diagram (PFD-01)



CAUTION: THIS PLAN MAY BE REDUCED 0 25mm 50mm ORIGINAL SCALE

NO.	REVISION	DATE	APRVD
0	O&M REVISIONS	08/10	

DRAWN JR AUG 2010
DESIGNED JW AUG 2010
CHECKED
REVIEWED

Baffinland Iron Mines Corporation

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PROCESS FLOW AND INSTRUMENTATION DIAGRAM
BAFFINLAND IRON MINES
POND WASTEWATER TREATMENT
DISSOLVED AIR FLOATATION SYSTEM

DATE: MARCH 2012
SCALE: N.T.S.
SHEET: 1 OF 1 SHEETS
PROJ No: TR1662
P&ID-01