Faro Water Treatment Plant Detailed Design Summary Faro Mine Remediation Project

PREPARED FOR: Government of Yukon

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Introduction

The purpose of this technical memorandum (TM) is to summarize the deliverables for the Detailed Design phase and identify key design features. The Detailed Design is the fourth phase in the CH2M HILL Canada Limited (CH2M HILL) four-phase design process. The Detailed Design provides additional detail after the Advanced Design phase (the third phase).

The following reports and technical memorandums were issued previously:

- The Water Treatment Plant (WTP) Design Definition Report (CH2M HILL, 2013a) describes decisions regarding process development.
- The Schematic Design Report (CH2M HILL, 2013b) provides the WTP design basis for all design disciplines for endorsement by the Government of Yukon (YG) prior to entering the Advanced Design phase of the project.
- A value engineering (VE) assessment took place in February 2013. VE alternatives were evaluated and the findings summarized in the VE Report (CH2M HILL, 2013c).
- The Advanced Design Summary (CH2M HILL, 2013d) describes the Advance Design phase deliverables and key design features of the WTP.

The Detailed Design phase includes the following deliverables:

- Drawings
- First drafts of the technical and front-end specifications
- An executive summary TM that describes Detailed Design deliverables and identifies key design features and issues that will need to be reviewed when the design is restarted in the future

Faro Mine Complex (FMC) is located in south-central Yukon, 15 kilometres north of the town of Faro. As part of the Faro Mine Remediation Project (FRMP), the replacement Faro WTP is designed to be a new, permanent replacement for the existing Faro Mill WTP because of the increasing risk of major equipment failure. The replacement Faro WTP is designed for longevity, durability, and future flexibility, and it will be heated and insulated for winterized operations.

The replacement Faro WTP will treat acid mine drainage by using a lime high-density sludge (HDS) process. The treatment system will be designed to treat an HDS-2 influent quality design flow of 44 megalitres per day (ML/d) and a maximum hydraulic throughput capacity of 55 ML/d. The Faro WTP will comprise three main facilities: the Lime Silo and Grit Building, the Water Treatment Building, and the Thickener. WTP processes include the following: a lime system; Reactors A, B1, and B2; sludge wasting pumps and sludge recycle pumps; the Thickener (55 metres in diameter); and a polymer system.

According to the Deferral of Faro Water Treatment Plant Construction Recommended Scope Modifications for Task Authorization 013 (CH2M HILL, 2013e), YG has decided to defer construction of the replacement Faro WTP until after completion of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) and permitting processes for FMRP. The deferral will likely result in a 5-year delay in the start of construction of the replacement Faro WTP; construction had been planned to start in 2015 but will now likely start in spring or summer 2020.

All procurement items planned during the Detailed Design phase were deferred, including the Thickener mechanism and dome; Lime Slaker Building equipment and Lime Silo; and Reactors A, B1, and B2. It was expected that shop drawings of the procurement items would be provided so that procurement details and the detailed design could be coordinated. The detailed design cannot be completed to 100 percent without the shop drawings. This TM discusses items that could not be completed as a result; these items will require further review in the future by the design team.

Key Design Features

The following sections discuss key design features of the replacement Faro WTP.

Water Treatment Building

Process areas consist of the following: process room, pump area, polymer room, blower/compressor room, mechanical room, electrical room, and access to the Thickener via the elevated walkway and the belowgrade Pipe Tunnel (i.e., the Thickener Tunnel).

Administrative areas consist of the following: control room with server room, washroom, laboratory, and break room. Future expansion of the administrative area would occur west of the replacement Faro WTP.

The Water Treatment Building will be designed as an engineered building with R-30 insulation in walls, R-40 roof insulation, and triple-pane windows. Belowgrade construction will consist of a concrete slab and walls that support the building. No areas will be classified as hazardous electrical locations.

At the reactor platform level, checkered plating has been minimized to allow easy crane access to the lower levels. Reactor A, B1, and B2 will be designed as welded stainless steel tanks for longevity and will be equipped with tank access ports on the side. The B1 and B2 reactors will be covered to reduce humidity and increase the longevity of the Water Treatment Building. An overhead crane will be equipped with a re-lamping platform to allow access to lighting and equipment under the roof.

The ventilation systems for the administrative area, the compressor and blower room, and the electrical room will be equipped with a heat recovery feature that sends waste heat from electrical equipment to the process room for supplemental heating. The process room will have a heat recirculation system, which consists of distribution ductwork that captures heat at the ceiling level and distributes it to the lower level.

The truck weigh scale is located west of the WTP and provides a means of verifying lime quantities delivered to the plant.

Thickener

The Thickener is designed to be winterized by the addition of an insulated dome with R-30 insulating value and perimeter heating. The Pipe Tunnel under the Thickener (i.e., the Thickener Tunnel) will have two means of egress. Previously, the Pipe Tunnel was designated a non-permitted confined space. However, as a result of the Value Engineering Report (CH2M HILL, 2013c) the Pipe Tunnel was extended to provide an exit south of the Thickener and is no longer a confined space. A lime feed to the Thickener will make pH adjustments for discharges to the Cross Valley Pond.

Lime Silo and Grit Building

The Grit Building will be designed as an engineered building with R-30 insulation in the walls and R-40 roof insulation. The building will accommodate a booster pump skid that is being purchased by the plant operator, Tlicho Engineering and Environmental Services, for use during the 2013 season to move flows from around the FMC. No areas will be classified as hazardous electrical locations.

Piping

Influent water will be supplied to the WTP from six pipe systems. Tie-ins will be provided to the three existing supply pipes to the existing Faro Mill WTP. These existing supply pipes are from Faro Pit, Intermediate Pond, and the Emergency Tailings Area. Provisions will be made for three future water supplies: the twinning of the Faro Pit pipeline, and the Cross Valley Dam seepage interceptor system, and the Vangorda and Grum pits.

Waste sludge from the Thickener will be pumped to Faro Pit by using sludge waste pumps and a new pipeline. In addition, accommodation has been made in the Grit Building for a Miller booster pump skid that was purchased by the plant operators for use during the 2013 season. Interconnecting piping and valves will be installed so that influent from the Emergency Tailings Area and the Intermediate Dam Pond can be pumped to Faro Pit by using the booster pump skid rather than pumping the influent to the WTP when the WTP is not operating. Pipeline options for conveying this flow to Faro Pit will be studied under a separate Task Authorization. The options include pumping through the influent pipe from Faro Pit or installing the future Faro Pit influent line in the current project.

Electrical and Controls

The WTP will have automated and manual controls. The power supply for the WTP will come from the existing Substation S1 and will terminate at a new transformer near the WTP. The power supply inside the WTP will be 600 volts and 208/120 volts, with grounding systems.

Future Expansion

The WTP will be designed to allow future expansion. Future expansion of the administrative area and, potentially, a maintenance facility would occur west of the WTP. Access to those future facilities would be through Corridor B.

Filters will not be provided at this time, but the design will allow future installation of a filter facility south of the thickeners. The design of the Pipe Tunnel (i.e., the Thickener Tunnel) will allow a connection to the future filter facility.

Design Issues That Need to be Reviewed in the Future

As previously discussed, YG has decided to defer construction of the replacement Faro WTP until after completion of the YESAA and permitting processes for the FMRP. As currently planned, YG and Aboriginal Affairs and Northern Development Canada (AANDC) will submit the Interim Works Project Proposal in spring 2017, with completion of the assessment process expected to occur by late 2018. After completion of the YESAA process, YG and AANDC will apply for a water use license. Although some construction activities may be possible before approval of a water use license in spring or summer 2019, approval of the license is not expected until at least late 2019. Therefore, the deferral will likely result in a 5-year delay in the start of construction of the replacement Faro WTP, which had been planned to start in 2015 but will now likely start in spring or summer 2020.

All procurement items planned during the detailed design were also deferred, including the Thickener mechanism and dome; Lime Slaker equipment and Lime Silo; and Reactors A, B1, and B2.

As previously discussed, it was expected that shop drawings of the procurement items would be provided so that procurement details and the detailed design could be coordinated. The detailed design cannot be

completed to 100 percent without the shop drawings. The following sections discuss items that cannot be completed and will require further review and consideration in the future by the design team.

Civil

Extent of unsafe and lead-contaminated areas: The extent of the unsafe and lead-contaminated areas are currently unknown. There is no overall plan showing these areas. A drawing has not been provided because not enough information is currently available. The ongoing sampling and testing program will obtain additional information that will need to be assessed and incorporated into the construction requirements, as appropriate. The current design assumes that YG will provide an appropriate landfill site within 10 kilometres of the WTP site for disposal of contaminated materials.

Geotechnical information along pipelines: The depth to rock and extent of fill or poor subsoil conditions along the pipeline alignments are not known. Further geotechnical investigations are underway, and additional investigations may be required to confirm existing conditions before tendering the pipeline work.

Septic system: The capacity, condition, and life expectancy of the existing sanitary septic system is not known. The current design assumes that the existing system has sufficient capacity and will be available for additional loading from the future WTP. Although the estimated loading of the replacement Faro WTP is minimal, the available capacity of the septic system will need to be verified in the future.

Well water supply system: The capacity, condition, and life expectancy of the existing well and associated piping system are not known. The current design assumes that the existing system has sufficient capacity and will be available for supplying non-potable water to the replacement Faro WTP. This will need to be verified in the future.

Existing pipeline conditions: The conditions and life expectancies of the existing piping systems are not known, and internal inspections and tests have not been performed, because these are not within the scope of TA013. The design assumes that the existing piping systems connected to the WTP (Faro Pit influent, effluent discharge, Intermediate Pond feed water, and Emergency Tailings Area feed water) will be available for the anticipated uses. This will need to be verified in the future.

Surge analysis for pump station(s) and associated pipeline requirements: The future contract will need to include a surge analysis and design update to validate the selected material and potential depth of burial considering additional geotechnical information and high-density polyethylene (HDPE) resin(s) that will be available in the future. The new, stronger PE4710 resin may change the pressure rating for standard HDPE dimension ratio classes and associated requirements for overall pipeline design that will need to be addressed prior to future tendering.

Barge pump supply system: The existing barge pumping system is not part of the scope of work and has not been evaluated as part of the replacement WTP design. It is not known if the barge is reliable to supply Faro Pit water to the replacement WTP. For example, the pump size, head, operating controls, and connections will affect the pipe design and will need to be coordinated in the future.

Relocation of the Environmental Storage Building: The Environmental Storage Building may contain a former well and associated equipment that will need to be decommissioned and capped. This needs to be confirmed. The preferred location for final installation and the associated building foundation and footing requirements also need to be determined if the building is not moved prior to construction of the replacement Faro WTP.

Underground utilities: The extent, materials, uses, and approximate burial depth of underground utilities could not be verified. Currently available location information is shown on the detailed design drawings but that information may be incomplete or inaccurate; this could result in additional construction costs when the work is performed.

Permitting requirements: The future requirements that will be established during the YESSA and permitting processes will affect construction requirements. These requirements will need to be assessed and incorporated into the future contract.

Structural and Architectural

Building code matrix and building code version: The design is based on the 2010 version of the National Building Code of Canada. The building code matrix and building design should be reviewed for compliance with the version of the code currently in effect at the time of construction.

Lime equipment procurement package: Final structural connection details between the selected Lime Equipment package and the Water Treatment Building will need to be determined.

Thickener dome procurement package: Final structural connection details between the selected Thickener dome package and the Thickener tank will need to be determined.

Reactor procurement package: Final structural connection details and walkway platform design and support for the selected reactor package will need to be determined.

Thickener mechanism procurement package: After preselecting the equipment, final details will need to be reviewed regarding the connection between the Thickener dome, Thickener mechanism bridge, and walkways from the Water Treatment Building and the stairwell south of the Thickener.

Truck weigh scale: The retaining wall design and the support details will need to be reviewed and modified to suit the vendor.

Other items: The following will need to be reviewed:

- Various detail enlargements will need to be prepared and incorporated in all structural drawings throughout.
- Steel pipe supports in the Water Treatment Building process room will need to be structurally modelled and sizing confirmed.
- South wall of Process Building, between grid lines 2 and 6: Clarify wall assembly (architectural and structural) to incorporate a new masonry wall extending to the underside of the roof truss for fire rating between the Process Building and the elevated walkway. Structural to add a column at end of the new masonry wall for lateral stability and verify that bracing does not interfere with the masonry wall. Provide 100-millimetre masonry cladding to columns at grid line 2 at entrance to elevated walkway to provide 1-hour fire rating. May need to clad truss.
- Detail of new outrigger penetrations on exterior of building required.

Process Mechanical

Tunnel overflow pipe: The overflow pipe for the Pipe Tunnel (i.e., the Thickener Tunnel) may need to be rerouted if the future filters are installed.

Lime equipment procurement package: The following will need to be reviewed:

- Final details regarding the piping connection between the selected lime equipment package and the Water Treatment Building.
- The lime slurry dosing mechanism and valve will be provided by the lime equipment vendor and finalized after vendor selection. The lime slurry recirculation pump discharge pressure depends on the vendor design.
- Compressed air demand is determined by lime equipment and will be finalized after vendor selection.

- The capacity of the grit conveyor in the booster pump and grit room will be finalized based on the lime equipment design.

Thickener mechanism procurement package: Details regarding the piping connection between the selected Thickener equipment package and the Water Treatment Building will need to be determined.

Reactor procurement package: Final details regarding the piping connection between the selected Reactors A, B1, and B2 and the Water Treatment Building will need to be verified with the vendor.

Other items: The following will need to be completed for the process design:

- Revise the process control narrative (PCN) for the preselected equipment. Operating and maintenance manuals for Lime Slaker Building equipment and Lime Silo, the Thickener mechanism, and polymer makedown and metering will be provided by the respective vendors and referenced in the PCN.
- Provide floor space in the Booster Pump and Grit Building for a second booster pump.

Building Mechanical

Sanitary drainage: Details regarding where the sanitary drainage will discharged to are needed. This will have an impact on the size of the sanitary sump pumping system.

Potable water supply: It is currently assumed that potable water supply will be provided by the existing supply arrangements (bottled drinking water is currently trucked in). Any alternative potable water supply connections from future sources will need to be coordinated.

Electrical

Lime Equipment Procurement Package: The following procurement specification items need to be verified:

- Verify overhead high-voltage line demolition and replacement requirements because lines might be modified under other tasks prior to the WTP construction.
- Confirm that the specification requires the Vendor is to provide one 15A/3P 600V circuit breaker for Sump Pump 16PMP53003 in the vendor supplied power panel.
- Confirm that the specification requires the Vendor to provide 10 percent spare breakers and 15 percent spaces in the vendor supplied Power panel.

Instrumentation and Control

The overall design of the instrumentation and control system is based on the Schematic Design Report (CH2M HILL, 2013b); however, the following aspects of the design need to be reviewed for the 100 percent design.

Control system:

- Evaluate the requirement to interface with external systems or other devices and provide suitable communication equipment including software. It is understood that communications devices are available at the FMC.
- The programmable logic controller (PLC) and the supervisory control and data acquisition (SCADA) workstation hardware have been specified based on current availability. This will need to be reviewed to specify compatible and current products that are as suitable for future scenarios.
- The specification has been developed based on the assumption that the programming for the WTP PLC and SCADA will be performed by the contractor. If this decision is revised, the specification will also need to be revised.

Preselect equipment packages:

- The signal interfaces with PLC for the preselect packages have been based on an understanding of tentative quotes obtained for these; in some cases it is not shown. Details need to be finalised when the vendor packages are selected.
- The design documents are based on an understanding that some packaged systems will be available in the future. If this changes, the design considerations and the design documents will need to be revised accordingly.
- The signals may need to be modified to suit the specific preselected equipment packages.

Works Cited

CH2M HILL Canada Limited (CH2M HILL). 2013a. *Water Treatment Plant Design Definition Report, Faro Mine Remediation Project*. Prepared for Government of Canada as Represented by Aboriginal Affairs and Northern Development Canada and Government of Yukon. January 22.

CH2M HILL Canada Limited (CH2M HILL). 2013b. *Faro Mine Water Treatment Plant Schematic Design Report, Faro Mine Remediation Project*. Draft. Prepared for Government of Canada as Represented by Aboriginal Affairs and Northern Development Canada and Government of Yukon. September.

CH2M HILL Canada Limited (CH2M HILL). 2013c. *Value Engineering Study of Faro Water Treatment Plant, Faro Mine Remediation Project*. Prepared for Government of Canada as Represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. January 29.

CH2M HILL Canada Limited (CH2M HILL). 2013d. *Faro Water Treatment Plant, Advanced Design Summary, Faro Mine Remediation Project.* Technical memorandum. Prepared for Government of Canada as Represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. October 3.

CH2M HILL Canada Limited (CH2M HILL). 2013e. *Deferral of Faro Water Treatment Plant Construction Recommended Scope Modifications for Task Authorization 013*. Technical memorandum. Prepared for the Government of Yukon. October 24.