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**Subject:** Re: IE Site Visit Report Nov 2014 - Final  
**Date:** Friday, February 6, 2015 9:30:26 PM  
**Attachments:** [\\_png](#)  
[2015-Feb-05 MELTA IE Site Visit Report - Nov 24-27 2014.pdf](#)

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A couple of minor points:

photos 6.3, 6.4, and 6.5 are dated two years in advance in 2016.

Towers in photos 4.3 and 5.1a are missing their yellow guy guards. While I followed up with Al Hacker to have them installed on the day of the tour, they are not present in the photos.

G



**Gilbert J. Bennett, P. Eng., FCAE**  
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James Meaney---02/06/2015 10:20:16 AM---Looks like they incorporated the comments we provided Assume we'd want to post this on MF website si

From: James Meaney/NLHydro

To: Paul Harrington/NLHydro@NLHydro, Gilbert Bennett/NLHydro@NLHydro, Karen O'Neill/NLHydro@NLHydro, Steve Pellerin/NLHydro@NLHYDRO,

Date: 02/06/2015 10:20 AM

Subject: IE Site Visit Report Nov 2014 - Final

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Looks like they incorporated the comments we provided

Assume we'd want to post this on MF website similar to July visit report.....I will confirm with MWH/Canada no issues with that

**James Meaney**  
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You owe it to yourself, and your family, to make it home safely every day. What have you done today so that nobody gets hurt?

----- Forwarded by James Meaney/NLHydro on 02/06/2015 10:18 AM -----

From: Nikolay Argirov <Nikolay.V.Argirov@mwhglobal.com>

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Date: 02/05/2015 09:19 PM

Subject: Site Visit Report

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Hello Folks,

Here is (attached) the Nov 24-27 (NALCOR) site visit report.

Regards,

Nik



2015-Feb-05 MFLTA IE Site Visit Report - Nov 24-27 2014.pdf



# MEETINGS IN ST. JOHN’S AND VISITS TO LOWER CHURCHILL PROJECT SITES, NOVEMBER 24 TO 27, 2014

Prepared for: Nalcor Energy

Project Manager: Nik Argirov

Date: February 05, 2015

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Prepared by	John Young, Hamdy Khalil & Nik Argirov
Reviewed by	Nik Argirov
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## APPENDIX NO. 1 - PHOTOS

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## 1. GENERAL

The MWH Independent Engineer (IE) team, together with a representative of Natural Resources Canada attended project briefings in St John's and participated in site visits to the Muskrat Falls Site during November 24 to 27, 2014 with representatives of Lower Churchill Management Corporation (LCMC), the Nalcor Energy subsidiary responsible for project development and management activities associated with the Lower Churchill Project. Site visits were made to project works sites in the area of Muskrat Falls in Labrador. Joseph Krupski represented Canada on the site visits and the Independent Engineer was represented by Nik Argirov (IE Project Manager), John Young (IE Geotechnical Subject Matter Expert (SME)), and Hamdy Khalil (Transmission SME ). Representatives from the Government of Newfoundland and Labrador (GNL) included Cluney Mercer, Cory Grandy and Emiliano Mancini (Ernst and Young). The itinerary was as follows:

- November 24:
  - am: Update briefings at the St. John's Lower Churchill Project office
- November 25
  - am: Travel from St. John's to Goose Bay
  - pm: Site visit to HVac transmission line, the spillway site and the powerhouse site
- November 26:
  - am: Debriefing meeting with LCMC staff in Goose Bay
  - pm: Detailed tour of the spillway concrete works, the powerhouse site, north service bay of the powerhouse. (John Young and Nik Argirov )
  - pm: Detailed tour of the different areas (and activities) along the HVac transmission lines (Hamdy Khalil)
  - pm (evening): Observed erection of HVac transmission tower under night time conditions
  - pm (evening): Travelled from Goose Bay to St John's
- November 27:
  - am and pm: Meetings in St John's and data redaction.

Principal observations and comments on the active construction works are presented in the following paragraphs. Labeled photographs are presented in Appendix 1.

## 2. NORTH SPUR

Design reports and analyses have been finalized for the North Spur Stabilization works. LCMC plans to hold a work shop in mid-January 2015 to do a final review of the planned works. This will be attended by the consultants responsible for the analyses and design, external experts and LCMC technical staff.

No significant works associated with the North Spur were going on during the time of the November 25 and 26 IE visit to the project site. Consequently no visit was made to this location at that time.



### 3. COFFERDAMS

Cofferdam performance throughout the past winter and summer has been excellent. There were no cofferdam construction activities at the time of the IE site visit.

### 4. TRANSMISSION LINES

#### 4.1. HVdc Transmission Line

There was no visit to the HVdc line sites.

#### 4.2. HVac Transmission Line – Goose Bay

The HVac lines consist of two parallel 315kV lines connecting from the proposed 735/315kV Substation (adjacent to Churchill Falls Switchyard) to the new Muskrat Falls Generating Station as shown in the diagram below:



The two new HVac transmission lines have separate structures and share the same right of way (100m) and also are parallel to an existing 138kV line. The lines are split into East and West segment. The East segment starts from the new Muskrat Falls Generation Station and runs to STR # 323. The West segment is between STR # 323 and the new 735/315kV Substation. Each line has bundled conductor (2-795kcmil – Drake / phase) and uses steel structures with horizontal configuration. There are approximately 1200 towers for the two lines. Line 1 is to the south and includes one OPGW (Optical Ground Wire) and one OHSW (Overhead Shield Wire) while Line 2 is to the north and includes two OHSW.

There is a full capacity redundancy, as only one of the HVac transmission lines with the bundle Drake conductor is capable of transferring the full load. In other words, one line can be totally out of service at a time with no impact on the load transfer.

The HVac transmission line work started in May 2014 and is proceeding on schedule. Right-of-way clearing, which started in September 2013, is at an advanced stage and tower installation work (Photos in Section 4 and 5 of Appendix 1) has commenced in the HVac line between Muskrat Falls and Churchill Falls. The IE visited the eastern end of the Muskrat Falls to Churchill Falls HVac transmission line on November 25 and 26, 2014 to observe tower assembly and erection works by Valard Construction. Observations made in the field include the following:



- The quality of clearing along the transmission line is good. The prevailing winter conditions, with the frozen ground surface, aid equipment trafficability along the cleared line.
- A large number of foundations (approximately 300) have been completed.
- 56 HVac towers (Photos 5.1a, b, c and 5.1d) had been erected at the eastern end of the line by the time of the site visits.
- No stringing or insulator/hardware has been installed yet.
- The IE witnessed the night time erection of a single foundation tower (Photos 4. 1, 4. 2a and b). The total time for the crew to move onto the site and erect the tower with a crane was just over one hour. When the IE team departed the site, crews were starting to secure to guy wires to the previously installed ground anchors.
- A site visit was made to the guy wire assembly facility (Photos 2.1 and 2.2) and typical guy wire attachment installations were viewed (Photo 4.3).
- Tower assembly work (Photo 3.2) at each tower site was continuing at the time of the site visit. A significant number of units (approximately 300) have been completed and are ready for erection.
- It is understood that work on the HVac transmission line is on schedule. All work is being done to an acceptable standard.
- The construction progress will be much higher during the 2014/2015 winter season.

It was evident that LCMC has the Construction Management team in place and are well positioned to continue the work in 2015.

## 5. SOILS AND CONCRETE LABORATORY

The IE inspected the soils and concrete testing laboratory on November 25, 2014. This facility is operational to carry out soil mechanics testing on fill samples and concrete testing. A program of concrete and RCC mix design is currently underway (Photos 6.1 – 6. 5). A full range of soils mechanics and various concrete aggregate quality testing is carried out on aggregate and fill samples. It is understood that this facility is utilized by all contractors when confirming compliance with various technical specifications. The facility is well equipped, albeit a bit on the small size for a project of this magnitude.

## 6. SPILLWAY

Excavation of the Spillway channel is 100 % complete and construction of the planned permanent works was well under way at the time of the IE site visit.

Concrete placement for the base slab in the spillway gates is complete. Formwork erection and concrete placement for the abutment and piers of the gate structure was at an advanced stage at the time of the site visit. The following observations were made during the site visit:

- Formwork erection and concrete placement work were underway in both abutments and all piers of the spillway structure (Photos 7.1 to 7.9). All works were enclosed in temporary shelters and heated with forced air heaters (Photos 7.6 to 7.9). This work is being carried out to a good standard and the shelter/heating arrangements are satisfactory for continuation of the work throughout the upcoming winter months.
- Steel rebar erections (Photos 7.5, 7.8 and 7.9) were observed in the various works and were of a good standard.
- A recently green cut horizontal construction joint was in Pier 3 as shown in Photo 7.9. This work was seen to be satisfactory.
- While it is understood that there has been schedule slippage, the activities and construction works observed during the site visit were all in accordance to good construction practice standards.

## 7. POWERHOUSE / TAILRACE

Excavation of the Power Intake/Powerhouse/Tailrace channel is 100% complete and construction of the planned permanent works was well under way at the time of the IE site visit.

Views of the powerhouse construction site are shown in Sections 8 and 9 of Appendix 1. Comments and observations are as follows:

- Astaldi Canada's progress on the Integrated Cover System (ICS) (shelter structure) for the powerhouse construction is behind schedule. At the time of the IE site visit the ICS structure was partially completed over two of the four bays (minus much of the wall cladding - Photos 8.1 to 8.5). It was understood that closed-in shelter will be provided for Bays 1 and 2 by January 2015 and Astaldi and Nalcor would consider options regarding Units 3 and 4. Other winter protection methods may be employed. Astaldi will make a final decision regarding Units 3 and 4 in January 2015. The final rock excavation faces of each generator unit bays were inspected (Photos 8.6, 8.7 and 8.8). As shown on the photographs, the blasting at each location is excellent and the resulting rock conditions are suitable for the planned installations.
- A relatively small block of permanent concrete has been placed in Unit 4 of the intake (Photo 8.11). No further work is planned on the intake concrete works in the immediate future. Work on this structure will proceed in earnest when there has been more progress in the Powerhouse construction.
- Erection and concrete placement facilities are being installed. As seen in (Photos 8.10 and 8.12), an overhead crane and beam have been laced over the Unit bay. A Putzmeister concrete pump has been erected on a fixed swivel mounting between Bays 2 and 3 in the Powerhouse (Photo 8.13). Additional pumps and rail cranes will be installed throughout the Powerhouse to make sure that all areas can be reached.
- Concrete placement for the transition dam between the Powerhouse excavation and the spillway was at an advanced stage (Photo 8.14). The left end structure was enclosed in weather protection shelter (Photos 7.1 and 7.2) and formwork erection/concrete placement work was underway at the time of the IE site visit.
- Foundation preparation works in the Powerhouse North Service Bay were inspected (Photos 9.1 to 9.6). A concrete base slab has been placed in the upstream side (Photos 9.1 and 9.2) and foundation preparation

work was underway at the time of the IE site visit. The rock mass in this area consists of competent, blocky granitic gneiss that is fresh to slightly weathered (Photo 9.4). The rock surface is being cleaned with water and with a large vacuum system in preparation for concrete placement (Photo 9.3). The work area is fully protected from the weather by a tarpaulin covering and heated with industrial heaters (Photos 9.5 and 9.6). The foundation preparation work is being carried out to an acceptable standard.

## 8. COMMENTS AND CONCLUSIONS

The following conclusions and comments are presented.

- The IE team visited construction operation at the HVac transmission line between Muskrat Falls and Churchill Falls. The quality of the line clearing and transmission tower construction work is very good. All work is being carried out in a very safe manner, in accordance with Nalcor/LCMC safety guidelines and regulations.
- Astaldi Canada's progress on the ICS (shelter structure) for the Powerhouse construction is behind schedule. At the time of the IE site visit the ICS portion over Bays 1 and 2 was substantially completed (minus much of the wall cladding (Photos 8.1 to 8.3)
- LCMC are actively working with Astaldi to identify and implement production improvements to maintain the schedule for River diversion in 2016 and First Power in 2017
- Initially, shelter was to be provided for Bays 1 and 2 by January and a decision will be made in January 2015 regarding winter protection for Units 3 and 4.
- During the IE site visit concrete works were underway for the spillway structure. While this work is behind schedule, there has been substantial progress with the concrete abutment and piers.
- No work was being carried out on the North Spur stabilization works at the time of the site visit and this area was not visited by the IE.
- Site camps and infrastructure are being utilized to house site workers as required. Roads are generally good, and are up the normal standard for a hydroelectric construction site.
- At all sites, the construction works are being carried out in compliance with very high standards of safety and environmental criteria.
- During the November 27 meeting in St. John's, LCMC advised on the positive outcome of the recently held discussions with Astaldi Canada's upper management. New reorganization of Astaldi and LCMC site personnel, targeting a significant contract progress improvement, will be implemented on the site during the holiday season shut-down period.

Appendix No. 1

Photos  
Muskrat Falls Site Visit - November 25 and 26, 2014

1. Foundation Installation



Photo 1.1 HVAC transmission line foundation installation. (November 25, 2014)



2. New Press and Guy Cables Assembly Area



Photo 2.1: Laydown and preparation of guy cables for HVac transmission towers. (November 25, 2014)

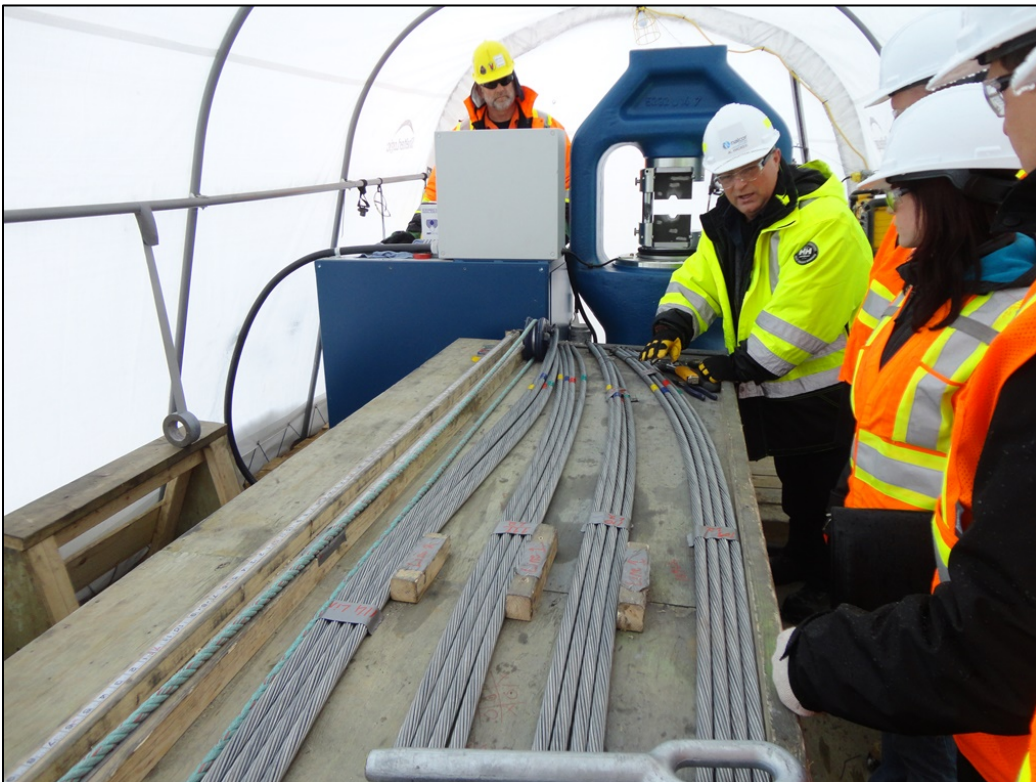


Photo 2.2: Laydown and preparation of guy cables for HVac transmission towers. (November 25, 2014)

### 3. Towers Assembly



Photo 3.1: HVAC transmission line structure assembly. (November 25, 2014)



Photo 3.2: Assembling a HVAC transmission tower near the North Spur. (November 25, 2014)



Photo 3.3: HVAC transmission line structure assembly. (November 25, 2014)

4. Structures (Towers) Erection



Photo 4.1: HVac transmission line – structure erection. (November 26, 2014)



Photo 4.2 a (left) and b (right) : Erection of HVac Transmission Tower 58 at sundown. (a) tower being hoisted into place with crane and excavator and (b) in final position, still suspended from the crane; note untethered guy wires at this stage of erection. (November 26, 2014)





**Photo 4.3:** Lower connection of guy cable on single footing transmission tower. (November 26, 2014)

5. Erected Structures



Photo 5.1a: HVac transmission line – erected guyed structure. (November 26, 2014)



Photo 5.1b: HVac transmission line – erected Self Supporting Structure. (November 26, 2014)



Photo 5.1c: HVac transmission line – erected Structures – Looking South toward both Lines. (November 26, 2014)



Photo 5.1d: Hvac transmission line – erected structures – Looking South toward both Lines, (November 26, 2014)

6. Site Laboratory



Photo 6.1 Site laboratory; mixer for concrete mix design. (November 25, 2014)



Photo 6.2: Site laboratory; mixer for concrete mix design. (November 25, 2014)



Photo 6.3: Site laboratory; graded aggregates for concrete mix design. (November 25, 2016)



Photo 6.4: Site laboratory , unconfined compressive strength testing of concrete cylinders. (November 25, 2016)



Photo 6.5: Drilled concrete cores from the field. (November 25, 2016)

7. Spillway



Photo 7.1: Spillway; view looking downstream towards the piers. RCC cofferdam is visible on the left side and the orange tarp covered transition dam is on the right. (November 26, 2014)



Photo 7.2: Spillway; view looking upstream towards the piers. RCC cofferdam is visible on the right side and the orange tarp covered transition dam is on the left. (November 25, 2014)





Photo 7.3: Right side of the spillway. Transition dam is visible at the top of the photograph. (November 26, 2014)



Photo 7.4: Spillway; view looking upstream between North Piers and Pier 1. (November 26, 2014)

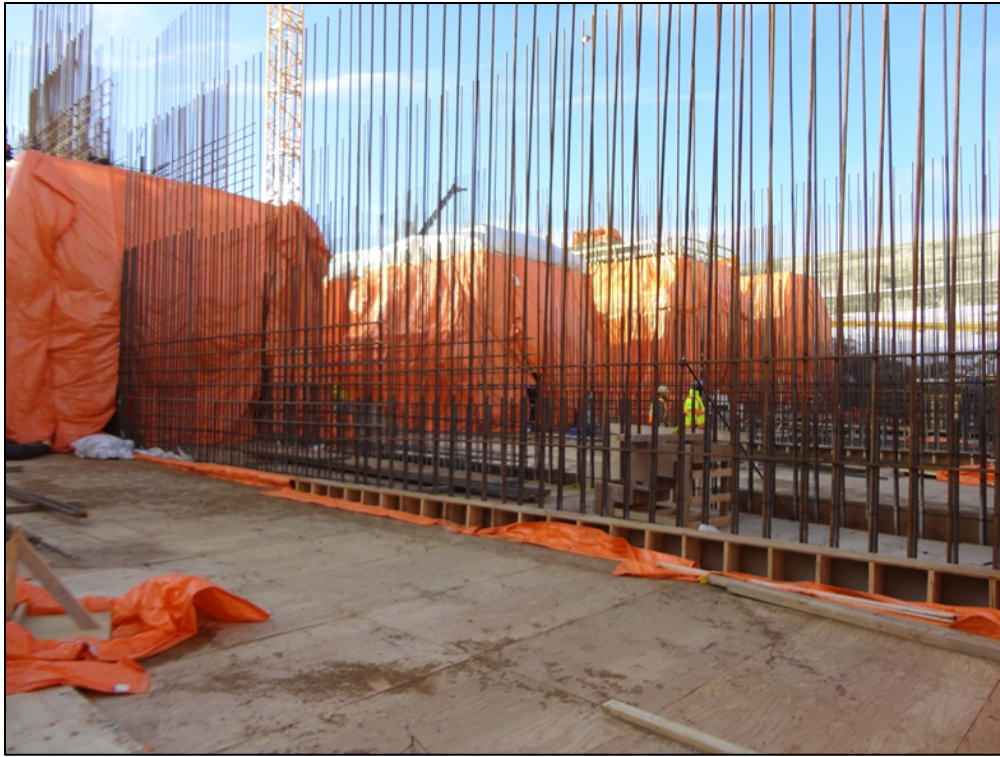


Photo 7.5: Spillway, rebar installation for Pier 3. (November 26, 2014)



Pier .7.6: Spillway; shrouded and heated formwork. (November 26, 2014)



Photo 7.7: Spillway; Wacker Neuson heater, one of many used for heating the formwork and concrete pours of the piers. (November 26, 2014)



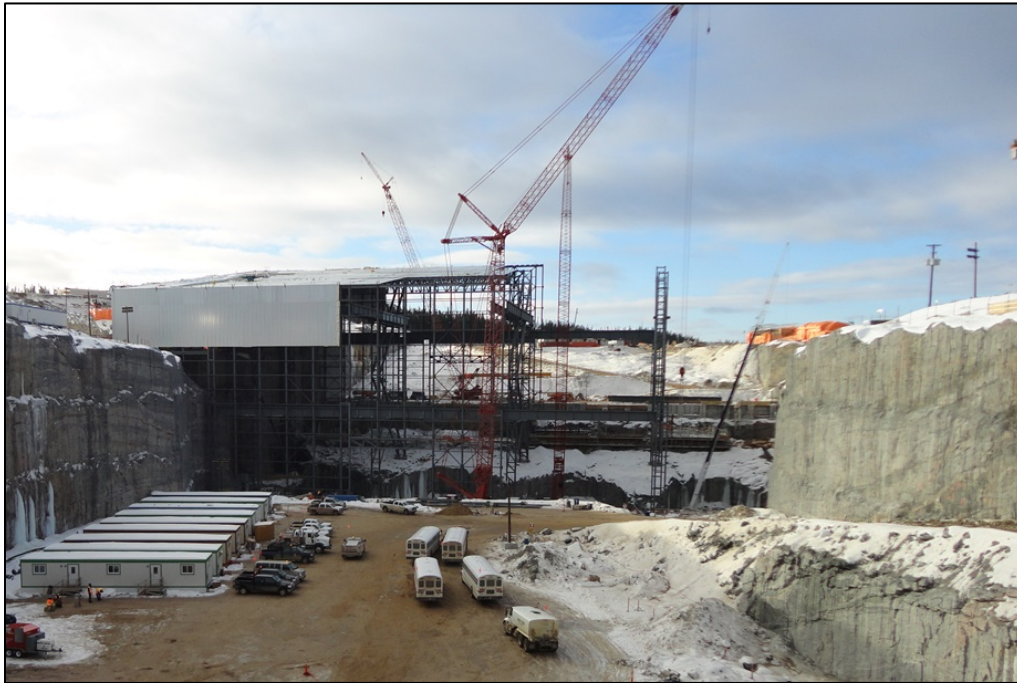
Photo 7.8: Spillway; Upstream nose of Pier 3. (November 26, 2014)



**Photo 7.9:** Current top of Pier 3 looking upstream. The concrete was green cut on the previous day and was currently being washed at the time of the photograph. Note the cut-out for the upstream stop logs in the background and the white water stop running down the centerline of the pier. (November 26, 2014)



**8. Powerhouse and Intake**



**Photo 8.1:** Powerhouse ICS looking upstream. Units 1 and 2 framework erection and first roof covering are substantially complete and almost half of the wall cladding has been erected. At Unit 3 the framework and first roof covering are substantially complete but no progress has been made on the wall cladding. No progress with the ICS in the area of Unit 4. . (November 26, 2014.)



**Photo 8.2:** Powerhouse ICS looking downstream. Framework and cladding in Units 1, 2 and 3 can be seen. (November 26, 2014.)



Photo 8.3: View looking upstream at the ICS construction over Units 1 and 2. (November 26, 2014)



Photo 8.4: View looking upstream at the initial ICS framework erection over Unit 3 (November 26, 2014)



Photo 8.5: Powerhouse ICS Roof over Units 1 and 2. (November 26, 2014)



Photo 8.6: Final rock faces in Powerhouse bays 1 and 2. (November 26, 2014)



Photo 8.7: Powerhouse Bay 2. Photo shows the excellent quality of the blasting. (November 26, 2014)

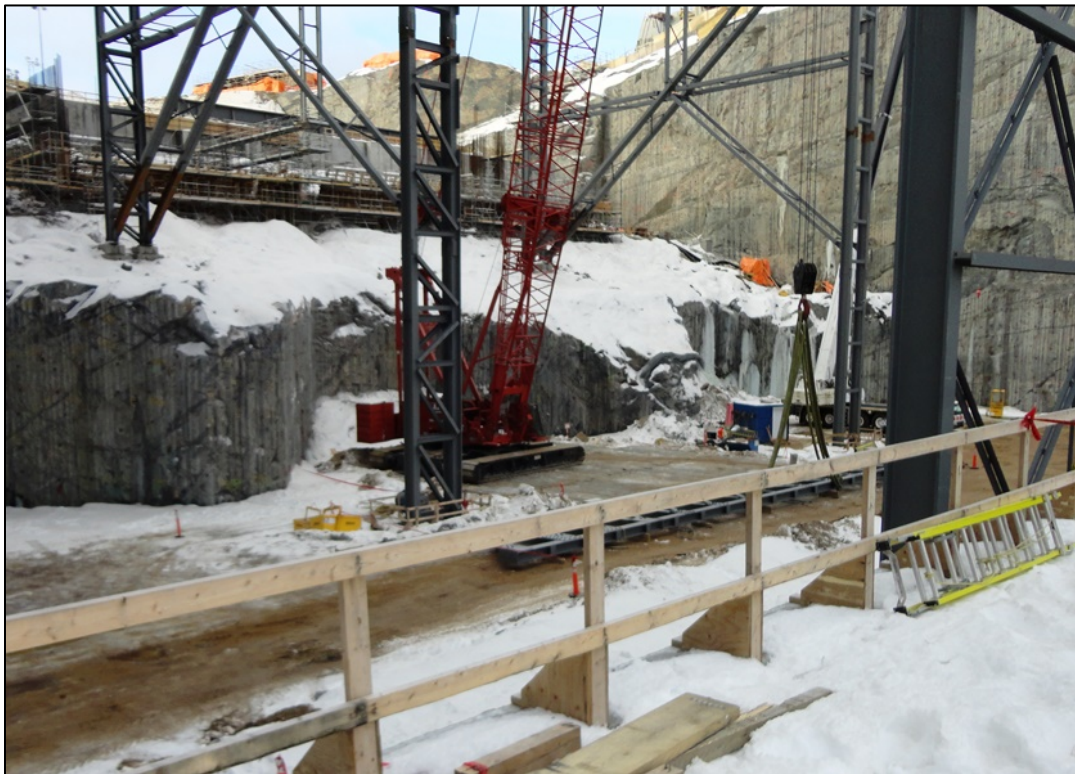


Photo 8.8: Final rock faces in Powerhouse at Bays 3 and 4. (November 26, 2014)





Photo 8.9: View looking upstream at the interior of the ICS over Bays 1 and 2. (November 26, 2014)



Photo 8.10: View looking downstream at the ICS framework over Bay 3. (November 26, 2014)



**Photo 8.11** Powerhouse, Bay 4. Permanent concrete at base of intake structure at Bay 4. This is the only permanent concrete in the powerhouse/intake structures. (November 26, 2014)



**Photo 8.12:** Powerhouse ICS. Beam crane above Unit 2. (November 26, 2014)



**Photo 8.13:** Putzmeister concrete pump on a fixed swivel mounting between Bays 2 and 3 in the Powerhouse. Additional pumps will be installed throughout the powerhouse to make sure that all areas can be reached. (November 26, 2014)



**Photo 8.14:** Right end of transition dam adjoining the powerhouse intake. (November 26, 2014)



**9. Foundation preparation and base concrete in North Service Bay**



**Photo 9.1:** Powerhouse north service bay foundation. Recently poured base concrete. (November 26, 2014)



**Photo 9.2:** Powerhouse north service bay foundation. Note wetted burlap mats being placed on the surface of the base slab. (November 26, 2014)



Photo 9.3: Powerhouse north service bay foundation. Cleaning the rock surface with an air vacuum and water jet. (November 26, 2014)



Photo 9.4: Powerhouse north service bay foundation. Cleaned surface in blocky granitic gneiss. (November 26, 2014)



Photo 9.5: Wacker Neuson heating unit used for heating the works in the north service bay. (November 26, 2014)



Photo 9.6: Backup heating plants for the north service bay foundation works. (November 26, 2014)