ONTARIO POWER GENERATION	Project Number: OTTO0021	Facility: Otto Holden G.S.	Page: 1 of 8
	BUSINESS CASE SUMMARY Replace Sluicegates & Rehabilitate Sluicegates System		

1. RECOMMENDATION

Approve the full release of $23.9M (including previous Developmental Phase release of $215k) to replace the six sluicegates and rehabilitate the sluicegates system in order to comply with dam safety requirements and to address operational and reliability needs.

The sluicegates can be controlled either locally or remotely from the Chenaux Control Centre. They provide a primary and effective means of discharging excess flow around Otto Holden G.S., and are essential in meeting the OPG Dam Safety Program requirements on expeditious discharge of large volumes of water in the event of a dam safety emergency. These sluicegates are nearing 60 years of operation and are at the end of their service lives. Failure of the sluicegates to operate could result in dam safety hazards to employees and the public, long term production losses and extensive property damage. In the recent past similar sluicegates at other stations (e.g. Chenaux) have jammed during operation, resulting in an uncontrolled loss of water. This project is part of an OSPG sluicegate replacement program to replace sluicegates within the plant group that are at the end of their service lives, including those at Des Joachims, Chenaux and Chats Falls. The plan at Otto Holden is to rehabilitate the sluicegates system in 2009, and replace the gates at a rate of one gate per year starting in 2010.

$215k was released in 2006 to perform definition phase work on this project. The definition phase work results and experience learned from recent sluicegate replacement projects provide a high confidence level for this full project release, with no need for a partial release.

Total Investment Cost: $23.8M (includes $215k previously approved for Developmental Phase work)

Recommended Alternative	LTD 2008	2009	2010	2011	2012	2013	2014	2015	Total
Project - Capital	194k	$4,730k	$2,855k	$2,971k	$3,097k	$3,222k	$3,324k	$3,463k	$23,856k
2008 Final budget Version WPC	172k	$4,572k	$4,887k	$2,590k	$2,667k	$2,747k	$2,830k	0	$20,465k

Expenditure Type: Capital
Investment Type: Regulatory – Dam Safety
Release Type: Full Release under OAR element 1.1.2
Funding: The 2008 Budget Version WPC includes $20.5M for this project. The new higher project cost reflects material cost increases in the last year and some scope changes, and will be re-programmed in the 2009 – 2013 Business Plan.
Investment Financial Measures: NPV = ($14,168k).

2. SIGNATURES

Submitted by:

15 Oct 2008
EVP - Hydro date

Finance Approval by:

Nov 1/08
SVP & CFO date

Recommended by:

Dec 3/08
EVP & COO date

Approved by:

Dec 4/08
President & CEO date

3. BACKGROUND & ISSUES

Plant:

Otto Holden G.S. is an eight unit hydroelectric station located on the Ottawa River 9 km north of Mattawa. It was placed in service in 1952. The station has a total capacity of 243 MW with an average annual energy production of 990 GWh, and production revenue of $52.8 Million in 2007.

The station is classified as a "Workhorse" in Hydroelectric's portfolio management system. Planned investments over the next ten years total approximately $71.4 Million, including concrete growth mitigation, sluicegates rehabilitation, headgates replacement, fire protection, and main output transformers replacement. The 2000 Otto Holden GS LCP includes a recommendation to rehabilitate the sluicegates in 3 to 7 years.

The facility is equipped with 6 sluicegates and 41 stoplog sluices for water management (flow control). To ensure timely response and satisfy dam safety emergency preparedness requirement, all 6 sluicegates and 15 stoplog sluices need to be available at all times. If one sluicegate is unavailable, the loss of flow capacity may be replaced with 4 stoplog sluices. However it takes approx. 4/8 hours (summer/winter) to strip 4 stoplog sluices with two three-man crews on site versus approx. 15 minutes to open a sluicegate with one crew. The stoplog sluices operation time will also be substantially longer outside normal working hours. For dam safety emergency preparedness purpose it is therefore much more efficient, effective and desirable to have all sluicegates available.

Issues:

The 6 existing sluicegates are 56 years old and near the end of their service life. In 1996 and 1998, gates #4 and #3 respectively were refurbished with new downstream cladding, sandblast and paint work, new internal heaters, lights, and access ladders, electrical work, bubbler system, etc. in an attempt to extend their service life. However without addressing the structural integrity, drive train mechanisms and civil aspects of the gates, the relatively minor rehab work did not extend the gates' service life significantly. The six gates have exhibited major operating difficulties in the past and Gate #1 has been impacted to the point where it is not used as it is not guaranteed to be able to close.

The monorail crane used to install sectional service gates has been forced out of service pending major repair requirements. Since the monorail crane is used very infrequently and only for gate maintenance, a technical/economic review concluded that it is much more cost effective to employ mobile rental crane to move the service gates than to replace the monorail crane. To improve safety in and access to the area, the out-of-service monorail system will be removed and properly disposed of under this project.

The 6 sluicegates are often used for routine water management operations, and are the primary flow control equipment at the facility because they can be fully opened in a much shorter time than a stoplog sluice, and each sluicegate provides flow capacity equivalent to about 4 stoplog sluices. The sluicegates are integral to Otto Holden fulfilling the OPG Dam Safety Program requirement in discharging Incremental Design Flood during a dam safety emergency. Failure and unavailability of one or more sluicegates will impact on the capability of Otto Holden to meet dam safety water control requirements.

The gates were inspected in 2003 as part of the Dam Safety Periodic Review (DSPR) and items were identified that need addressing, such as the structural integrity of the skinplates and the buckling safety factors of some of the beams. Visual inspections of the gates carried out in 2004 revealed that the skinplates on all the gates have deflected from 1/16" to ½", indicating that the skinplates have been loaded beyond their yield strength. An Engineering Assessment performed in 2006 by OSPG Asset Management/Technical Services Dept. concluded that the gates are showing signs of structural failure and also do not meet modern strength requirements. The assessment recommended replacement of these sluicegates to prevent such failures.

Other sluicegate system deficiencies and recommendations from the DSPR and assessment include:

1. The embedded parts (roller paths and seal paths) are deteriorated and need to be refurbished. The concrete surrounding the roller path (secondary concrete) is also in poor condition and needs to be replaced.
2. The sluicegate electrical distribution system was updated in 1996, but will need modification/replacement in order to support new gates, control systems, correct existing design deficiencies, and to be consistent in design with other OSPG sites undergoing similar sluicegate systems rehabilitation programs.
3. The sluicegate bridge and tower structure are recommended to be sandblasted and have new protective coating applied.

Lessons-learned from recent sluicegates replacement projects at other OSPG plants show that it is more cost effective to replace the sluicegates rather than refurbishing them. A Developmental Phase Release was approved in 2006 to prepare detailed design specs and obtain release-quality cost estimates to replace the sluicegates and rehabilitate the sluicegates system. The Developmental Phase work was completed and the cost estimates used for the basis of this Full Release are consistent with recent similar sluicegate replacement projects. The slightly higher costs for this project (over other sluicegate projects) reflect recent material cost increases and the more extensive concrete repair required in the roller path/gain areas at Otto Holden.

4. ALTERNATIVES & ECONOMIC ANALYSIS

Base Case: Status Quo. Initial Cost = $189k. NPV = 0.

- Do not replace the sluicegates, rehabilitate sluicegates system, and repair concrete in the sluicegate areas.
- Failure of sluicegates to operate would create unacceptable hazards in facility operation and dam safety due to the risk of gate overtopping and the consequent safety concerns to employees and the general public.
- To not proceed with this project exposes OPG to dam safety non-compliance risk, in that timely, reliable water flow control through these sluicegates is necessary in the event of normal spill requirements, unexpected plant shutdowns, or a dam failure.
- OGP would not realize the benefits of already expended funds if it does not proceed with this project.

To conform to dam safety requirements, personnel and public safety concerns in the event of a dam safety incident, this alternative is unacceptable.

Alternative 1: Rehabilitate 6 sluicegates and the sluicegates system now. Initial Cost = $54,042k. NPV = ($16,080k).

- In this alternative the 6 sluicegates will be rehabilitated rather than replaced.
- New gates would need to be installed in 2035 at $29.5M (escalated). This cost is reflected in the $54,042k above.

Rehabilitation provides an extension life of 25 years maximum with gate replacement required in 2035. There will also be higher on-going maintenance expenses associated with rehabilitated gates. There is a high risk of budget overrun from as-found defects and discovery work during rehabilitation of over 50-year old sluicegates. This alternative is not recommended.

Alternative 2: Replace 6 sluicegates and rehabilitate the sluicegates system. Initial Cost = $23,856k. NPV = ($14,168k).

- Rehabilitate the sluicegates system, and remove and dispose of the monorail crane system in 2009.
- Replace the 6 sluicegates with new gates at a rate of one per year starting in 2010. As each gate is being replaced, rehabilitate gate hoist drive and concrete in roller path/gain areas of the gate.
- New gates are technically superior to rehabilitated gates. New gates incorporate the benefits of technology progress made over the past 50 years, are engineered and fabricated to modern standards, and have life expectancies of up to 50 years.
- The environmental risk is less with a replacement gate, with no in-situ abrasive blasting/containment/painting operations over water.
- The risk to on-site worker safety is less for gate replacement than for the in-situ gate rehabilitation.
- Cost projections are subject to a lower degree of uncertainty for new gates than for rehabilitated gates. Typically it is the bid price.

This is the recommended alternative.

Financial Analysis

	Base Case	Alt. 1	Alt. 2 (recommended)
Initial or Remaining Costs (escalated k$)	194	54,042	23,856
NPV (2008 k$)	0	(16,080)	(14,168)

5. THE PROPOSAL

Replace the 6 sluicegates and rehabilitate the associated systems with results delivered as per the following schedule:

Year 2009

- Remove and properly dispose of existing electrical distribution system and gain heaters. Replace with new upgraded electrical system.
- Integrate gate control and telemetry into plant RTU.
- Sandblast and paint the entire sluiceway superstructure.
- Remove and properly dispose of the monorail hoist, beam and crane.
- Design, construct and install a stair tower on the Ontario end of the sluice structure using grating style stair treads and bar grating for the landings.
- Where applicable and required, install proper lighting and kickboards, repair/replace bridge deck grating.

From Year 2010 through Year 2015, remove and properly dispose of existing sluicegates, replace with new gates, refurbish hoist drive, repair concrete downstream of the gains, commission and return the specific gate in service on a one gate per year basis, under the following schedule:

Year	2010	2011	2012	2013	2014	2015
Gate to be replaced	#1	#6	#5	#2	#4	#3

Gate replacement sequence is prioritized by gate condition and with poorer conditioned gates given higher priority. The above sequence reflects current condition of the 6 gates. This sequence may be modified during the 6-year project period as dictated by any gate condition changes. Lessons learned from the recent Des Joachims sluicegate replacement project has shown that replacing more than one gate per year is too aggressive a schedule and impractical.

A Project Execution Plan (PEP) will be used to monitor the project progress.

Lessons-learned meetings will be conducted in Q4 of each year following each gate replacement and a list of actions developed and implemented on the subsequent replacement. The PEP will be updated and issued by Q2 of each year and prior to the start of installation of the next gate.

6. QUALITATIVE FACTORS

- Public safety risk due to uncontrolled spill will be minimized.
- Environmental Risk will be minimized, as there will be no in-situ sluicegate repairs near open water with the installation of new gates.
- The sluicegate replacements will be of modern design and latest technology, and have a life expectancy of 50 years.
- New gate seals will minimize water losses currently experienced with the 1950's technology and aged gate seal installations.

7. RISK ANALYSIS

Risk Description	Impact	Initial Risk (before Mitigation) (H,M,L)	Mitigating Activity	Residual Risk (after Mitigation) (H,M,L)
Cost				
1. Project costs escalation.	1. Exceeding release amount.	1. M	1. Estimated costs were obtained from 2006 contractor estimate and adjusted for inflation. They are also consistent with actual costs from recent similar sluicegate rehab projects at other OSPG facilities.	1. L
2. Material escalation costs.	2. Exceeding release amount.	2. M	2. Project contingency included covering the anticipated steel price increases.	2. L
Schedule				

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BUSINESS CASE SUMMARY
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Risk Description	Impact	Initial Risk (before Mitigation) (H,M,L)	Mitigating Activity	Residual Risk (after Mitigation) (H,M,L)
1. Equipment installations delayed due to weather.	1. Delays in-servicing of equipment.	1. M	1. Strategy to install only one gate per year reflects experience from other similar projects. Also start work each year as soon as spring flows permit. Extend hours of work as required to maintain schedule.	1. L
2. Gate replacement delayed due to longer than anticipated spring freshet.	2. Sluicegate outage commencement start date deferred.	2. M	2. See #1 above.	2. L
Operational				
1. Sluicegates unavailable during outage for approx. 4 months.	1. Loss of flow control equipment.	1. L	1. Remaining five sluicegates will remain operational plus the additional flow control available with the 41 log sluices during traditional low flow periods within the 4 months of construction.	1. L
2. Sluicegate freezes in open position if commissioned during winter months.	2. Loss of flow control equipment and production losses.	2. M	2. Sluicegate commissioning to be conducted during favourable weather conditions. e.g. prior to late fall or winter months.	2. L
Environmental				
Debris and contaminants entering the water course during demolition and construction.	Violation of the Environmental Protection Act resulting in fines and works stoppages to OPG and contractor.	M-H	An environmental assessment will be incorporated into the tendered documents to ensure environmental requirements are met. Execution plan, based on previous similar gate replacement project experience, will be implemented to minimize the impact to the environment. Sectional gates will allow installation to be performed in a dry environment.	L
Resources				
Labour disputes resulting in strikes by BTU trades.	Defers the outage commencement date.	L	Work is in Quebec and a labour process similar to the Chestnut Park Accord process will be followed. Verify BTU trades contracts prior to initiating yearly construction work.	L

Risk Description	Impact	Initial Risk (before Mitigation) (H,M,L)	Mitigating Activity	Residual Risk (after Mitigation) (H,M,L)
Technical				
1. Discovery work during gate replacement.	1. Lengthens outage period.	1. M	1. Experience and lessons learned from other PG sluicegate replacement projects will be fully utilized in advanced work planning to avoid/mitigate this risk. Total replacement of gate minimizes this risk.	1. L
2. Commissioning tests indicate gate does not operate according to Technical Specification.	2. Unavailable flow control capability	2. L	2. Project strategy and technology are proven in recent other PG sluicegate replacement projects. Pre-approved vendor/contractor will be used to ensure work quality.	2. L

8. POST IMPLEMENTATION REVIEWS

- Project management will conduct a lessons-learned exercise following each gate replacement and revise the PEP for the next gate replacement.
- Project Management will demonstrate functionality and commissioning tests following each installation, witnessed by Production and Asset Management/Technical Service Department representatives.
- Project Management will provide commissioning test report.
- Commissioning will be in accordance with the following documents:
  - Periodic Review of Mechanical Equipment Used for Flow Control (DS-STD-09 R03)
  - Periodic Review of Electrical Equipment Used for Flow Control (DS-STD-10 R01)
- Project Management will provide actual costs vs. estimated Q4 of each installation year and rationale of any variances incurred
- The PIR report will be completed by the Ottawa/St. Lawrence Plant Group Asset Management Department 6 months after final in-service report is completed - 2013.

ONTARIO POWER GENERATION

HYDROELECTRIC
Summary of Estimate - Capital

Date	September 10, 2008
Project #	OTTO0021

Facility name: **Otto Holden G.S.**

Project Title: **Replace Sluicegates & Rehabilitate Sluicegates System**

	LTD	2009	2010	2011	2012	2013	2014	2015	TOTAL	%
Project Management/Engineering **(012)**	20k	40k	40k	40k	45k	45k	45k	45k	320k	1.3
Consultant/Engineering **(310)**	170k								170k	0.7
Construction/Installation										
Hydroelectric (PWU labour) **(010)**		60k	30k	30k	30k	35k	35k	35k	255k	1.1
Contractor/ (BTU labour)/EPSCA **(310)**	[redacted]									
Materials **(200)**	[redacted]									
Interest **(700)**	4k	120k	73k	76k	79k	82k	85k	89k	607k	2.5
Contingency **(998)**	[redacted]									
TOTAL	**194k**	**4,730k**	**2,855k**	**2,971k**	**3,097k**	**3,222k**	**3,324k**	**3,463k**	**23,856k**	**100**

Notes: 1 Schedule: Start Date: January 2009 (Execution Phase)
In-service Date: November 2015

2 Interest and escalation rates are based on current allocation rates provided by Corporate Finance

3 Includes removal costs of: $457k

4 Includes Definition Phase Cost of: $194k

Prepared by:	Approved by:
Project Engineer/Officer	Production/Project Manager
Date: Sept 23, 2008	Date: Sept 29/08