# Alton Natural Gas Storage

# River site Monitoring Plan During Cavern Development Dec 10, 2015

Monitoring required for industrial approval

This monitoring plan can be adjusted by agreement between Nova Scotia Environment and Alton Natural Gas Storage based on new information that may become available during cavern development.

DFO recognizes that the 24 day shutdown period could include days with minimal volumes of eggs in the river, however due to the unpredictability of the start of peak spawning, a conservative period of 24 days is recommended for the first year of brining operations. DFO will work with Nova Scotia Environment, the proponent and other stakeholders to examine methods to better predict spawning activity as well as understand the potential risks of operations during the spawning period which may allow for a shorter shutdown period in the future.

**Plankton and fish monitoring**

1. River monitoring

a) Alton river site monitoring – Plankton sampling, to determine Striped bass egg and larvae presence
   - Day time flood tide (30 second long) plankton net sampling in the main river channel at the river site will be conducted every 10 minutes on the 90 minute flood-tide. Sampling frequency, when the mean daily water temperatures reach $11^0$C, sampling will be daily on the daytime flood tide seven days a week until live Bass eggs are detected
   - When eggs are detected at the Alton site on the flood tide sampling, brine discharge will be stopped and Nova Scotia Environment will be notified. This will trigger operational measures to further protect the eggs. See discharge monitoring and the operational plan sections

b) Striped bass spawning site monitoring
   - Water temperature will be monitored continuously at the Alton river site during operations and when the spring time mean daily temperature reaches $11^o$C then degree days will calculated as an additional indicator of potential Striped bass spawning events

- When the mean daily water temperature is above 11$^{o}$C, the Striped bass spawning site will be monitored daily as described below
- Weather forecasts will be closely monitored in anticipation of warming temperatures leading to spawning events
- Gaspereau fishers congregating at the 'Fish Shack' (local fishing community hub, Main St West, Stewiacke) will be consulted at least twice weekly. Through their handling of striped bass by-catch and word-of-mouth, they know the state of sexual maturation of the striped bass
- Striped bass spawning locations from the hwy 102 to the CN Bridge on the Stewiacke River will be visually monitored for indication of spawning events
- These will give us an indication of when to expect Bass spawning to begin.

c. River wide monitoring will be supported throughout cavern development to better understand the ecological function and productivity of the estuary

2. Constructed Channel Monitoring

a) Channel use monitoring - migration routes, DFO permit required

- Atlantic salmon smolt acoustic tagging will be conducted to see if they use the channel – in the spring of the first year of operation
- Striped bass acoustic tagging will be conducted to see if they use the channel – in the first year of operation
- Vemco receivers: one will be located in the center of the new channel and one on each side of the river up-estuary of the channel

b) Water intake

- Pump tests sampling for all the species, numbers, life stage and mortalities based on the cubic meters of water sampled
- Samples will be taken at the intake face, and in the intake well inside of the gabion face
- Velocities at the intake face will be measured during low flow, mid-flood tide, slack tide, and mid-ebb tide along transects along the face to obtain a picture of the current patterns during intake
- Sampling frequency will be three times a week when withdrawing water starting the first Monday in May through to July 15, then once a week through to September 30$^{th}$
- Additional tests may be approved by DFO and scheduled to coincide with Science sampling in the river during the shutdown period to determine the potential impact on Bass eggs and larvae. This information is to be used in developing modifications to the intake operation when the brine release has been stopped.
- The plankton including Bass eggs and larvae are not harmed in the sampling and can be counted and returned to the river. This will not give information on how mature the eggs and larvae are just their number. It should be noted that natural conditions result in 7% to 10% dead eggs in a sample.

- Pump tests in the wet well may be taken when not withdrawing to see if tidal flows bring any eggs or larvae into the intake.

c) Brine discharge site during outfall operation

- Pump test sampling as above at the discharge site at low water /mid tide /high water
- Five meters from the outfall in the direction of the flow at low flow, mid-flood tide, slack tide, and mid-ebb tide
- Sampling frequency will be three times a week when discharging brine from the first Monday in May through July 15, then once a week through to September 30th
- This sampling has to be paired with the plankton tows in the river so that we know the portion of dead eggs naturally in the water column
- Additional tests may be approved by DFO and scheduled to coincide with Science sampling in the river during the non-brining period to determine the potential impact on Bass eggs and larvae to be used in modifications to the operations n as toxicity test do not duplicate exposure times and concentrations they will be subject to at the outfall. .
- The eggs and larvae can be checked and returned to the river but some live eggs and larvae collected during brine release should be kept to study the long term survival. This will require a DFO science permit.

## Water chemistry and temperature monitoring

a) River wide monitoring

Alton site

- Conductivity Depth Temperature (CDT) data logger will be placed on the bottom of the river 100 meters downstream of the constructed channel
- Frequency: On-going, real-time logger recording each 10 minutes and downloaded bi-weekly during the ice free months, and when there is safe to access them during the winter

Alton Channel Monitoring **(the river site)**

**Discharge site**

- At five meters either side of the toe of the outfall an array of conductivity sensors at 1.5m vertical spacing. Bottom, 1.5m, 3.0 m and 4.5m linked to the computer system for ongoing salinity calculation and adjustment of discharge

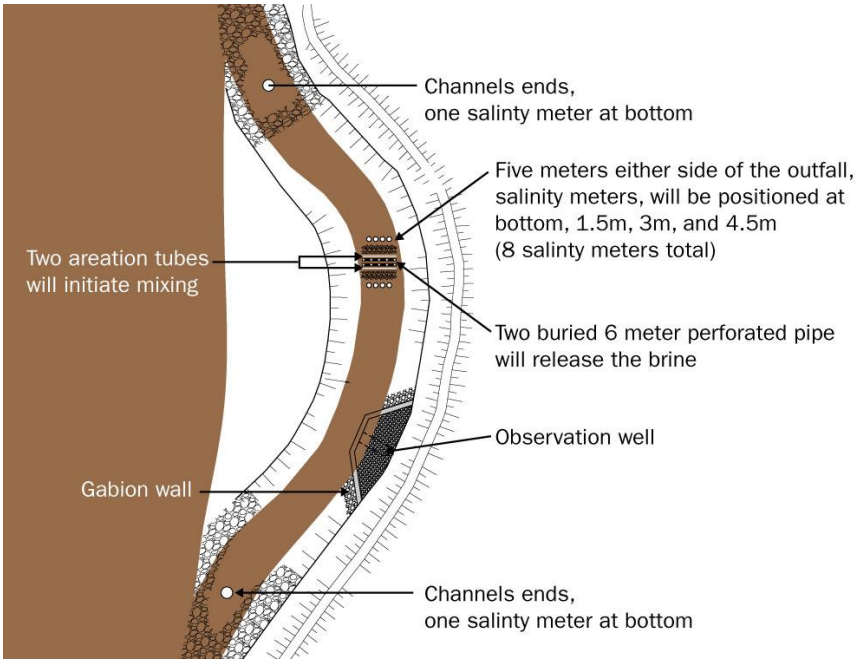
flow. Sampling frequency planned for all year but may have to be adapted if ice cover affects probe's functioning. Only during discharge

**Channel ends**

- CDT data loggers at bottom at both ends of the channel. Sampling Frequency, ongoing readings recorded each 10 minutes. Data down loaded daily during the first week of start-up and then weekly until full brining is achieved. Following that ramp up period the data will be downloaded weekly. Weekly during periods of no brine release. These are the compliance points.

**General water sample testing**

- Starting in spring 2015 and continuing for one year, water samples will be collected monthly at high and low tide at the Alton site on the Shubenacadie River estuary. Samples will be tested for standard water analysis, and total metals. This testing will allow for baseline data to capture the natural water quality conditions in the river. Sampling may not be completed in months when the river is ice-covered
- When the Alton Natural Gas project is withdrawing Shubenacadie River water and brining the salt caverns, water samples will be collected from the water tank at the cavern site (river water that the sediment has settled out of and has gone through the filters), the brine pond at the outlet end and the Shubenacadie River at low and high tide. All four samples will be tested for standard water analysis, total and available metals, and petroleum hydrocarbons. These samples will be collected monthly for the first four months, then will move to quarterly sampling Additional samples may be requested by the Government based on this data.
- Core samples of the mud flat on the west bank of the Shubenacadie River at the Alton site were collected to document background conditions and tested for total and available metals and NORMs
- The Shubenacadie River water will be tested for NORMs twice before brining begins.
- Brine in the brine pond will be tested for NORMs before caverns are 25% developed. Based on that sample, additional sampling may be required




Schematic of the placement of the ten salinity meters within the constructed mixing channel.

## Operational Plan

### Discharge operation

- Salinity data is recorded every minute from the meters immersed in water column. They will be averaged automatically by the computer (five meters either side of the brine discharge averaged separately). If average salinity over a 10 minute period is 7ppt above background or above 28ppt, the discharge flow will be reduced by 20% by the computer system. The discharge flow will continue to be reduced by 20% every 10 minutes until the average salinity is within 7ppt of background and at or below 28ppt
- From the date that Stripped bass eggs are detected the brine discharge will be stopped for 24 days. From start-up following the no brine release period until July 5$^{th}$, the discharge will be regulated as above to maintain salinities at or below 7ppt above background and at or below 20ppt.
- The compliance points are the loggers at the ends of the channel. Meeting the standard 5m from the outfall is precautionary and allows time for adjustments in brine flow as above
- The automatic reduction in brine flow will shut down all the brining within 50 minutes

**Striped bass egg and larvae**

- Spawning site non-invasive information gathering, combined with the detection of eggs in the tows on a day time flood tide and intake structure at the Alton site, will trigger the stop of brine release operations for 24 days
- After 24 days when brine release operations resume, sampling will be restarted at the intake structure as per the proposed schedule in the intake monitoring section above.
- If Striped Bass eggs are detected in the intake well or river at the site after the 24 day period, both NSE and DFO will be contacted to determine if further action is necessary.

**Intake and outfall samples**

- Eggs, larvae and fish of all species will be visually checked for signs of injury due to the intake or contact with the brine
- If impacts are identified corrective action plan will be prepared and implemented by changing operating conditions to prevent further harm
- It is not expected Bass eggs will enter the intake well, but if they are found in the intake well, changes in operations will be made to prevent further intake. This may mean a shutdown, but could also be corrected by shifting the timing of intake on the tide

**Water samples**

- Changes in water chemistry of the brine during cavern development will be kept within the background levels in the river. This will be done by comparing the tidal river water quality with the average quality of the brine diluted to equal to or less than 7ppt salinity
- River water and brine mix elemental composition will be within the natural variation in the river

**Striped bass egg and larvae toxicity testing**

- Toxicity testing on the bass eggs and larvae will be conducted using the protocol approved by DFO

**Reporting**

- The monitoring data will be available to Nova Scotia Environment, Fisheries and Oceans Canada and Environment Canada and a designated First Nations organization upon request.
- Reports will be sent to Nova Scotia Environment on a quarterly basis