

Dugouts

REPORT ON MANAGING DUGOUTS IN NORTHEASTERN BRITISH COLUMBIA

Prepared for the Ministry of Forests Lands and Natural Resource Operations

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March 2017

Revised July 2017

Minor revisions were made to this report in July, 2017 to clarify some statements and correct an error with respect to an incorrect date.

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1. Introduction

Dugouts used for water supply in northeastern British Columbia are not anything new. Most farms used them for cattle watering. They were generally near the farm house and buildings to supply water for fire protection and some even supplied water for household use, although usually not for drinking. Most of the agriculture is dry-land farming but some dugout water was used to irrigate gardens.

Dugouts, as the name implies, were originally simple structures dug out of the ground, which filled with rain water or from snow melt. Some excavations were made in “wet” areas where the water table was very near the surface and the hole created intercepted the water table and filled with groundwater. Where highway construction was done in a “borrow and fill” manner, construction material was often taken from borrow pits, which then filled with water becoming dugouts. In a few cases, landowners would get permission to divert stream water into a dugout at certain times of the year to store water for later use. These original dugouts had two things in common: they were generally small, around one-quarter hectare or less in area and they were generally all below the surface of the surrounding ground, i.e. with no berm, dam or embankment on any side to contain the water.

The use of directional drilling, advances in the technology of hydraulic fracturing and the use of multi-well pads, have combined to make viable the exploration and development of the natural gas deposits in British Columbia. Hydraulic fracturing in this way requires large quantities of water to be available at the well site. Progress Energy, in a joint venture with Petronas is one of the biggest landowners in the Montney gas play. In 2008 they fractured 1400 new wells. By 2012 this was down to 700 due to the financial crash in 2009 and the low natural gas price. In 2016 they are still one of the most active drillers in British Columbia. Progress Energy reports that they would typically fracture a well 8 to 10 times to bring it into production. In the Montney Basin, they used 10,000 to 30,000 cubic metres of water (m³) per well. In the Horn River Basin, they used 25,000 to 70,000 m³ per well.¹

This water is taken from a surface water source or a ground water well, pumped to a truck and then hauled to a gas well site. Initially, long lines of trucks would haul water to a site where fracturing was taking place. This was expensive, slow and caused traffic problems. Soon dugouts were appearing in proximity to one or more well sites. Water could be hauled to the dugout in advance of the fracturing operation and pumped directly to the well site from the dugout. Pumping from a groundwater well to fill a truck could be slow and surface water sites were often not convenient to access or could only be used by one truck at a time. Dugouts were constructed close to water sources where pumps could run

¹ Numbers reported by Steve Dunk, Progress Energy. BCWWA *Conference on Hydraulic Fracturing*, Fort St. John, March 23, 2012

constantly, or well in advance of the need to fill and maintain the water level in the dugouts. Trucks could fill and haul water from these source dugouts to the well or to the dugout at the well site.

Not all dugouts are simple holes in the ground. It has been reported to, and observed by, Ministry staff that many “dugouts” are constructed on sloping ground where it is necessary to build a berm or embankment on one or more sides to contain the water. It has also been reported that some of these berms might be classified as dams and should be regulated as such. Two dugouts have been reported as being of such a size they should have had an environmental impact assessment. As a result of these reports and staff observation, both the Oil and Gas Commission and the Ministry of Forests, Lands and Natural Resource Operations have begun several actions.

Water use in British Columbia is regulated under the *Water Sustainability Act* (WSA) and Regulations. Water policy is a responsibility of the Ministry of Environment. Authorizations for water use (and other resource uses) are mainly a responsibility of the Ministry of Forests, Lands and Natural Resource Operations (FLNRO). The Oil and Gas Commission (OGC) is the single-window regulatory agency with responsibilities for regulating oil and gas activities in British Columbia. The authority to review, assess, and make decisions on water authorizations for the oil and gas sector is designated to the Commission by way of the *Oil and Gas Activities Act* (OGAA). The *Water Sustainability Act* is a “specified enactment” under the OGAA and the legislation provides authority for the OGC to authorize short term use of water and changes in and about a stream, as well as issue permits over Crown land under section 10, 11, and 24 of the WSA. In addition, by way of a Memorandum of Understanding between the agencies, certain staff in the OGC have been designated Water Managers under the WSA and these individuals have the authority to issue water authorizations, as well as all the other authority of a water manager.

Both the Oil and Gas Commission and the Ministry of Forests, Lands and Natural Resource Operations have Compliance and Enforcement staff in their agencies and they share responsibility for enforcing legislation regarding unauthorized use: the OGC for the water use associated with the oil and gas activities and the Ministry for water use in all other activities. And of course, there are some grey areas.

This report summarizes an initial assessment of the issue of dugouts in the Northeast Region of British Columbia and makes recommendations on how to manage the issues that arise. Section 2 is a preliminary assessment of the scope and magnitude of the issue. Section 3 deals with the policy and legislation and the rationale for government intervention. Section 4 summarizes the issues and Section 5 provides recommendations. Section 6 provides a preliminary work plan and gives an analysis of the workload implications.

2. Scope and Magnitude of the Issue

Natural gas development occurs in northeastern BC in four main areas: the Montney, Liard, and Horn River Basins and the Cordova Embayment. Most of the activity in 2016 was in the Montney Basin due to the easier access to infrastructure and the highway network. In 2015, there were no hydraulically fractured wells in the Horn River Basin or Cordova Embayment. Only 2 wells were fractured in the Liard Basin and there were 11 others outside the main basins. The vast majority of the current activity is in the Montney Heritage and North Montney Basins and it is expected that the most of the dugouts will be found there.

For 2015, The BC Oil and Gas Commission reported² that 26 companies used a total volume of 7.74 million m³ for hydraulic fracturing of 534 wells. Total water use in the Montney area was about 7.5 million m³ for fracturing 521 wells. This is an average of 14,392 m³ per well (slightly lower in the Heritage Basin and higher in the North Basin).

Natural gas wells bring up “flowback” water, which is water that comes back up the well immediately after fracturing and “produced” water, which is water that comes up with the gas in the first few months of gas production from the well. Disposal of this water is regulated because it is contaminated with additives and petrochemicals. This water is normally disposed of by deep injection into an underground formation. Progress Energy reported in 2012 that about 40% of the water they used for fracturing was a combination of recycled flowback water and produced water. The OGC reported in 2012 that the average recycling rate in British Columbia was about 35%. Produced water may be discharged on the surface if treated and if a permit is obtained under the *Environmental Management Act*. As of this writing, no permits are believed to have been issued.

OGC reports the sources for acquisition of water used for hydraulic fracturing as follows:

- 35.8 % Private Acquisition or Produced Water
- 23.2 % Short-Term Water Use Approval
- 22.3 % Water Licence
- 15.0 % Flowback (estimation)
- 3.1 % Water Source Wells (shallow and intermediate/deep).
- 0.6 % Municipal Waste (Shell)

The 2015 OGC water use report for sources of water shows only about 15% of the water is recycled flowback water. Produced water, which is also recycled, is reported along with “privately acquired water”. This means a total recycling rate cannot be determined but it is probably still around 35%. This means 65% of fracturing water must come from surface or groundwater sources.

² BC Oil and Gas Commission. *Water Management for Oil and Gas Activity*. 2015 Annual Report, page 18.

For the wells in the Montney Basin, in 2015 this means at least 65% of 7.5 million m³ or 4.9 million m³ is non-recycled or “new” water. Of the water withdrawn under Short-Term Water Use Approvals, the OGC reports for 2015 that 1.4 million m³ came from water source dugouts. Most of the water obtained under water licences is not from a water source dugout. It is unknown how much of the Private Acquisition water comes from dugouts but it is expected that most of it is. If 35% recycling is assumed, and 15% of the total is reported as Flowback Water, then the other 20% must be part of the 35.8% Private Acquisition/Produced Water, leaving 15.8% Acquired Water. We can apply this 15.8% to the total 4.9 million m³ and get 0.77 million m³. This rough calculation says that 1.4 million plus 0.77 million or up to 2.2 million m³ of water was sourced from dugouts in 2015. If we imagine the average Olympic swimming pool 25 m by 50 m by 2 m deep, holding 2,500 m³, there would be nearly 900 such dugouts.

But this is only part of the equation. There are also many dugouts located in proximity of the well pads in order to have the water available for fracturing. The number of these is currently unknown. Clearly another method is needed for determining the number of dugouts in BC. There is also a need to determine whether these dugout include a dam as part of their construction.

Remote Sensing

Alexandre Bevington, Research Earth Scientist with the Ministry of Forests, Lands and Natural Resource Operations, is working on a project to map constructed surface water storage structures from satellite imagery in the Northeast Region of British Columbia. The collaborative work aims to create an inventory of dugouts over the satellite record (i.e. 1985 – 2016) and assess their characteristics (size, type, proximity to streams, etc.). The following section summarizes the satellite remote sensing work that has been done to date, for more details please refer to a 2017 draft paper³.

Freely available 10 meter resolution cloud-free satellite imagery was used from a new European Space Agency satellite launched in 2015, Sentinel-2A (<https://sentinel.esa.int>). It acquires images of the entire Earth every 10 days in both visible and infrared wavelengths. The infrared wavelengths allow for more robust mapping of water bodies. Similarly, the US based Landsat Program provides freely available 30 meter resolution satellite imagery from 1985-2016⁴ (<https://landsat.usgs.gov/>). The two datasets complement each other as Sentinel-2A has 2016 images at 10 m resolution, and Landsat Program has a rich archive at a lower 30 m resolution.

³ Bevington, Alexandre. *Mapping Constructed Water Storage Structures in the Northeast Region of British Columbia*. Working Draft: 2017-02-24.

⁴ Landsat imagery between 1972 and 1984 was acquired at a 60 m resolution, insufficient for this project. The cost per Landsat image has varied between \$400 and \$4500 over the programs lifetime until the Landsat archive became free to the public in 2008. To do this project pre-2008 would have cost have cost an estimated 3 million dollars.

Water storage structures have been mapped over 78 % of the Northeast Region of British Columbia (see *Figure 1*). The area mapped represents 483,000 km² of the total 623,000 km² of the Northeast Region.

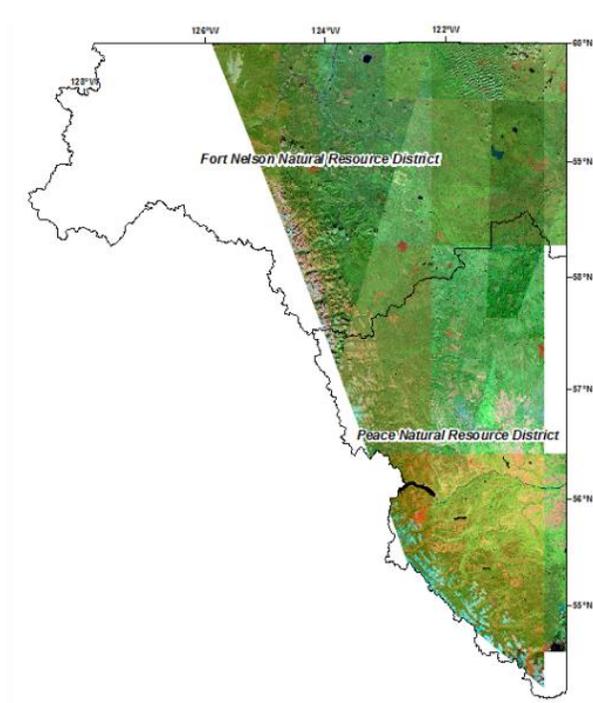


Figure 1: Coverage of the Sentinel-2A images from June 1st to September 30th, 2016. The northwest area was excluded, a band along the Alberta border from 57 to 58 degrees latitude was snow covered and a small patch at the southern limit had no cloud-free 2016 data (Bevington 2017).

A semi-automated water detection algorithm was developed for the 2016 Sentinel-2A imagery. Then for all dugouts larger than 1 hectare, the Landsat archive was investigated to find the year of construction. The mapping results are filtered to remove natural water bodies and mapping anomalies (e.g. flooded fields, dark north facing slopes, etc.). The smallest detectable water body is 100 m² (one Sentinel-2A pixel) though a minimum of four adjacent pixels (400 m²) was used to increase confidence in the results. High resolution (50 cm) satellite imagery acquired between 2008 and 2016 from the internal British Columbia Ministry of Forests, Lands and Natural Resource Operations DigitalGlobe© imagery license (set to expire in April 2017) was used to manually confirm the findings. The DigitalGlobe© imagery license cannot be used for automated water mapping water for numerous reasons: (1) the image files are 400 times larger than Sentinel-2A and 3600 times larger than Landsat, (2) they have no infrared data, and (3) have very few images per site.

Bevington manually classified the dugouts into 4 categories based on interpretation of their assumed use:

- **Agricultural (AG)** dugouts are characterized as being relatively small and in a field with only a rough dirt road for access or are located close to a farm house or farm access road and could be larger.
- **Exploration (EX)** dugouts are characterized as being located right beside resource extraction roads (e.g. forest service roads or petroleum development roads). These are generally larger than AG dugouts and are not in proximity to any built-up infrastructure. They are generally spaced along the roads and may have been borrow pits for road construction materials.
- **Municipal (MU)** structures are related to municipalities and are generally within municipal boundaries. They are probably water or waste water storage ponds. Some are found on golf courses, mines, or public infrastructure.
- **Oil and Gas (OG)** dugouts are in close proximity to well pads or gas infrastructure. Some are large and some have retaining walls that are visible in the images and some are small and dug below the surface.

Bevington also classified the dugouts by size. The area of the dugouts was calculated using the dugout outline results from the semi-automated water detection algorithm using 10 m resolution data. As such, the area calculations have important limitations that relate to the resolution of the input data (see Bevington 2017 for more discussion). Dugouts smaller than 4 pixels (0.04 hectares) were omitted from the study. The size classes chosen were: Small (0.04 ha to <0.1 ha), Medium (0.1 ha to <0.5 ha), Large (0.5 ha to <1.0 h) and Very Large (>1.0 ha).

Table 1 shows the number of dugouts detected and the total area for each type and size class by District in the Northeast Region. The area displayed in hectares after the number of dugouts is the total area for that number of dugouts. For example, in the first row, it can be seen that 18 agriculture dugouts total only 1 hectare in size for all 18 or an average size of 556 m².

Table 1: Total count and total area (in hectares) of dugouts by District, type, and size class.

District	Type	Size class								Total	
		Small		Medium		Large		Very Large		count	area
		count	area	count	area	count	area	count	area	count	area
Fort Nelson District	AG	18	1	7	1	0	0	0	0	25	2
	EX	404	22	1157	292	123	79	12	16	1696	409
	MU	9	0	5	1	3	2	5	11	22	14
	OG	86	5	241	67	92	63	47	85	466	220
	Total		517	28	1410	361	218	144	64	112	2209
Peace District	AG	2156	95	534	99	23	14	3	4	2716	212
	EX	1247	66	830	157	28	18	3	4	2108	245
	MU	89	4	61	14	15	11	29	107	194	136
	OG	277	16	357	78	79	55	50	84	763	233
	Total		3769	181	1782	348	145	98	85	199	5781
Northeast Region	AG	2174	96	541	100	23	14	3	4	2741	214
	EX	1651	88	1987	450	151	96	15	20	3804	654
	MU	98	4	66	15	18	13	34	119	216	151
	OG	363	20	598	145	171	118	97	169	1229	452
	Total		4286	208	3192	710	363	241	149	312	7990

*Area totals do not all add up as they have been rounded to the nearest whole number.

Water management basins (WMB) subdivide large watersheds into management units that are not based on the order of the basin (e.g. 1st, 2nd, etc.) but rather into management areas of approximately equal area (e.g. Lower, Middle and Upper Pine River). These basins were obtained from the British Columbia Oil and Gas Commission Open Data Portal.

Figure 2 (below) is a map of the total amount of all constructed water bodies in the study area. The top five WMB are the Lower Beaton River, the Pouce Coupe River, the Lower Kiskatinaw River, the Lower Peace River and the Blueberry River. If we considering only the constructed water bodies larger than 0.5 hectares, the top five WMB are: the Middle Fort Nelson River, the Kiwigana River, Sahdoanah River, Hay River and the Lower Petidot River.

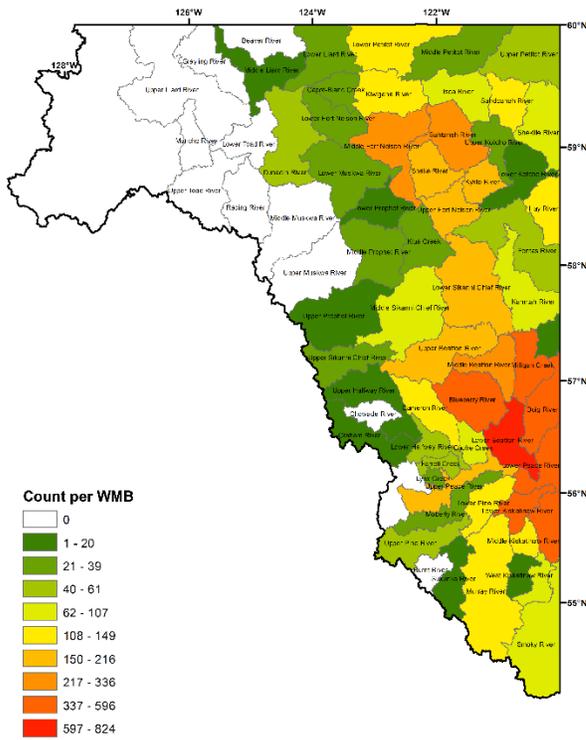


Figure 2: Density map of the total number of mapped constructed water bodies for each water management basin.

When considering only the 149 Very Large dugouts (i.e. > 1 ha) over the 1985-2016 Landsat imagery, the number of dugouts constructed per year peaked in 2012 and was still relatively high in 2016. The 1985 spike in the graph represent all features constructed before 1985. A steady increase of large OG type constructed water bodies began around 2008 and peaked in 2012. Nevertheless, 2016 was still an important year in the construction of large water bodies.

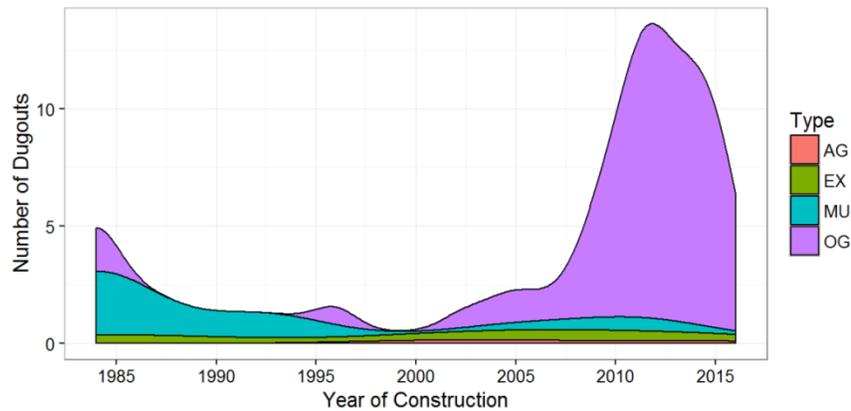


Figure 3: Number of Very Large (> 1 ha) constructed water bodies built per year, and colored by type (Note: the 1985 values include all features constructed before 1985).

3. Policy and Legislation

Before embarking on a program of investigation and enforcement, there must be well-supported and clearly articulated reasons for government action. The policy must be well understood and the action must be founded in legislation.

3.1 POLICY

There have been dugouts in the northeast for many decades. People are building more and everybody seems happy. It must be asked: What is the policy rationale for government intervention?

With respect to dugouts, there are 5 grounds for action:

1. Protection of human safety and protection of property,
2. Good stewardship of the environment,
3. Orderly use of lands and water,
4. Respect for government legislation, and
5. Fair and equitable fees.

Each of these grounds for action are discussed below.

Protection of human safety and protection of property

Testalinden Lake was a small reservoir in the Okanagan holding about 55,000 m³ of water, artificially created by a small dam less than 10 m high. In mid-June, 2010, the dam failed. Only about 20,000 m³ of water escaped and ran down a gully for 8 km, by which time it was a debris flow of about 200,000 m³. It destroyed five houses, blocked Highway 97 for five days, covered a four hectare orchard and a vineyard with one and a half metres of mud, and resulted in nine million dollars in damages. Fortunately, there was no loss of life.

It is easy for untrained eyes to underestimate the damage that can be caused by escaping water. The 20,000 m³ of water that escaped from Testalinden Lake would fit in a dugout 50 m by 100 m by 4 m deep. There are many aspects of human life where safety standards are regulated by government and dugouts which have one or more sides above ground pose a hazard that can, and should, be regulated where there is risk to human life, infrastructure and property.

Good Stewardship of the environment

Unregulated diversion and use of water can reduce flows in a stream causing habitat loss, temperature stress and oxygen deprivation for fish as well as habitat loss for birds, aquatic mammals and reptiles. Similarly, “clearing” out a wetland to create a dugout can destroy habitat and aquatic plants and vegetation that provides shade to cool the wetland. Proper regulation can help to avoid damage and minimize habitat disruption.

Orderly Use of Lands and Water

Taking any water from a surface water source and putting it into storage requires a licence or approval and has done for over 150 years. Initially, the legislation was enacted in 1859 to ensure orderly use of water during the gold rush in BC. The intention was to regulate the water use to ensure that the maximum amount of gold could be produced from the use of water in placer mining. The advantages of orderly use spread to regulating land and water use for agriculture use and, over time, to all human activities that required the use of land and water.

Properly managing the use of water in the gas fields today will ensure that water is available as needed for extraction of natural gas, while ensuring water availability for other uses of water, and protecting existing users and the natural environment.

Respect for Government Legislation

Government passes laws and makes regulations for good reasons. Failure to enforce some of these laws and regulations breeds disrespect for laws generally and causes disorder. It then becomes much harder to regain control and corporate losses, civil distress and environmental damage often occurs before order is reestablished.

If an activity is prohibited or controlled by a law, then the people who respect and obey that law expect enforcement action to be taken against others who do not comply.

Fair and Equitable Fees

Currently, people who use surface water are required to obtain a water licence as discussed below. They pay an annual fee for the licence that is based on the purpose for which they intend to use the water and the quantity they propose to use. Small domestic use, prospecting for minerals and firefighting is exempted from the licensing requirement. The *Water Sustainability Act*, which came into force on February 29, 2016, puts many of the same requirements on water from groundwater sources.

Ignoring people who fail to pay their fees or fail to register or license their activity and pay no fees will cause the ones who are already paying to either stop paying or petition government to take some action. Not only does this bring about a loss of revenue to government but it, too, causes disrespect for government and can lead to disorder.

3.2 LEGISLATION

As discussed above, there are sound policy reasons for government to intervene in the proliferation of dugouts in the northeast of BC. This section will examine the legislative tools that are available for government to deal with the issue.

There has been much legal advice given to the Ministries about dugouts under the former *Water Act* and there has also been advice and training delivered on the new requirements of the *Water Sustainability Act* and this will not be repeated here. However, a general overview of the legislation is given as it applies to dugouts and specific issues with respect to dugouts are addressed.

Large areas in the Northeast are covered by *the Agricultural Land Reserve (ALR)*. This Act covers non-farm use in Section 20:

Use of agricultural land reserve

20 (1) A person must not use agricultural land for a non-farm use unless permitted under this Act.

(2) For the purposes of subsection (1), except as provided in the regulations, the removal of soil and the placement of fill are non-farm uses.

(3) An owner of agricultural land or a person with a right of entry to agricultural land granted by any of the following may apply to the commission for permission for a non-farm use of agricultural land:

(a) the Surface Rights Board, or its predecessor, the Mediation and Arbitration Board, under the Petroleum and Natural Gas Act, the Mining Right of Way Act, or section 19 of the Mineral Tenure Act;

(b) [Repealed 2010-9-1.]

(c) any other authority under an enactment.

(4) A person who intends to use agricultural land for a prescribed use that involves soil removal or placement of fill must give notice of that intention to the commission in the prescribed form at least 60 days before engaging in the intended use.

(5) In response to a notice under subsection (4) or if a person engages in a use specified in subsection (4) without giving the required notice, the chief executive officer, by written order, may

(a) if the owner of the land agrees to restrictions on the use, specify terms and conditions for the conduct of that use of the agricultural land, or

(b) order that an application to the commission under subsection (3) is required for permission to engage in the use and may include as a term in the order that the person cease or not engage in the use until the application is determined.

(6) If the chief executive officer does not respond to a notice under subsection (4) within 30 days by making an order under subsection (5), the owner of the land may engage in the intended use.

The *Agriculture Land Reserve Use, Subdivision, and Procedure Regulation* under **Part 1, Interpretation**, in Section 2:

- 2 (3) For greater certainty, water is not a farm product for the purposes of the Act or this regulation.

Under **Part 2 – Permitted Use**,

Permitted uses for land in an agricultural land reserve

- 3 (4) The following non-farm uses are permitted in an agricultural land reserve and must not be prohibited by a local government bylaw or, for lands located in an agricultural land reserve that are treaty settlement lands, by a law of the applicable treaty first nation government:

- (i) surface water collection for farm use or domestic use, water well drillings, connection of water lines, access to water well sites and required rights of way or easements;

It would appear that the collection of surface water for farm or domestic use might be permitted in a dugout, as would be the construction of a dugout. However, the removal of soil off of the ALR property and the placement of fill brought onto the ALR property if required for building a large dugout with a berm or embankment, would not be allowed unless permitted. The *Agricultural Land Reserve Act* is not a specified enactment under the *Oil and Gas Commission Act* but the OGC has been delegated authority to authorize certain non-farm uses. It is understood that the OGC has authorized under the delegation agreement some water storage structures built by gas producers. It is understood that these permits extend to private land that is leased by gas producers as well as for structures on Crown land.

Further investigation and legal advice should be sought on the matter of large water storage structures inside the ALR (see Recommendation # 15).

Small Domestic Dugouts

The use of water is described in general in the *Water Stewardship Act* (WSA) in Section 6. This section clearly states that a person must not divert water from a stream or an aquifer, or use water diverted from a stream or aquifer unless the person holds an authorization (6(1)(a)) or the diversion and use is authorized under the regulations (6 (1)(b)). Section 6(2) exempts diverting and using water for extinguishing a fire and for testing the quality or quantity of water or to conduct a flow test. A further exemption is provided by Section 6(3) for domestic use of water or prospecting for a mineral with some restrictions. Section 6(4) provides that groundwater may be diverted and beneficially used, including storing, for domestic purpose without further authorization. Some restrictions to this are given in Section 135 authorizing a regulation to close or restrict access to a source or Section 136 which allows for regulations to require authorizations to be obtained for the use of

groundwater in specific aquifers in a designated area. No Section 135 or 136 regulations have been passed to date.

The Section 6(4) exemption would provide for small dugouts filled by groundwater to be used for domestic purposes without the need for a water licence in those instances that meet the “domestic” definition of water used for “...household purposes ... by the occupants of, ..., one or more private dwellings... including, without limitation, the following uses:

- (a) drinking water, food preparation and sanitation;
- (b) fire prevention;
- (c) providing water to animals or poultry kept (i) for household use, or (ii) as pets;
- (d) irrigation of a garden not exceeding 1,000 m² that is adjoining and occupied with a dwelling;

Stock watering beyond one or two head for domestic purposes would not be allowed under this exemption. Government is known to be looking at some changes to this exemption to provide for additional limited uses such as stock watering.

In this regard, it is useful to look at Alberta’s legislation with respect to dugouts. Alberta requires that an approval or licence be obtained before undertaking a construction activity in a water body or before diverting and using water (surface and groundwater). Alberta dugouts that contain less than 2,500 m³ and that do not take water from a fish-bearing stream or from a water source that has been reserved or restricted do not require an approval from the government. Licences are only required where water is pumped into a dugout and the dugout has a capacity greater than 12,500 m³ or the total diversion from the dugout is greater than 6,250 m³ per year. Certain other restrictions apply. It would certainly be helpful from a regulatory standpoint if BC adopted similar (or the same) regulation (see Recommendation # 13).

It should also be noted that the Dam Safety Regulation applies to any dam, licensed or not, and even a small domestic dugout may trigger the Dam Safety Regulation if it meets the criteria as discussed below.

There are three circumstances in which the *Water Stewardship Act* (WSA) may apply to non-domestic dugouts. Each is discussed below followed by a review of the applicable sections of the Dam Safety Regulation.

Dugouts Filled by Surface Water

It has been a requirement in British Columbia since 1859 that permission be obtained to divert, store and use surface water with only a few exceptions. Today, those exemptions are for fire-fighting, water testing or as described in the Regulations. The purposes for which water may be used are outlined in the WSA Part 1, Sec. 2. A “**water use purpose**” is a purpose defined in Sec 2 but also includes a subset of a purpose also defined in Section 2. Subsets are used in the fee regulation and clarify the calculation of the fees. Examples of subset purposes are used below.

There is an “**oil and gas purpose**” that means *the use of water in the development of petroleum or natural gas wells or the production of petroleum or natural gas resources*. There is no “drilling” purpose nor a “hydraulic fracturing purpose” – these are subset purposes. A natural gas company that wanted to divert water from a stream into a dugout to store it for use in hydraulic fracturing would need to obtain a licence authorizing the use of water for “Storage” and “Oil and Gas (hydraulic fracturing)” purposes. The *Water Sustainability Fees, Rentals, and Charges Tariff Regulation* (BC Reg. 37/2016) [the **Fee Tariff**] Distinguishes the Oil and Gas Use Purposes into 5 subset purposes:

- Oil field injection – other than deep groundwater
- Oil field injection – deep groundwater
- Hydraulic fracturing – other than deep groundwater
- Hydraulic fracturing – deep groundwater
- Drilling

The distinction is made here because the use of deep groundwater is regulated by the Oil and Gas Commission and no fees are charged under the WSA for use of deep groundwater.

Also included in Section 2 is “**storage purpose**” which means *the impounding and retention of water for subsequent use for a water use purpose*. This means that you cannot get a licence just to store water. You must get a licence to store water and also to use water for another defined purpose. An exception is “**conservation purpose**” which provides for diversion, retention and use of water for the purposes of conserving fish or wildlife and includes the construction of works for that purpose. This could mean storage and use in one word and has been used to authorize Ducks Unlimited Canada to build what are essentially dugouts for waterfowl habitat, although fees are charged for both the conservation purpose and the storage used for conservation purpose. There has been inconsistency here over the years and some licences specify the use as “conservation and storage” on the face of the licence, which is maybe a better signal to the administrative people who calculate the fees.

In the past there were two subsets for storage purpose: power and non-power. The current Fee Tariff has only one fee for storage. Many older licences distinguish between Storage-power and Storage-non-power. This distinction is no longer necessary and can be ignored on new licences. Simply authorize “Storage”.

Four licences have been issued for Oil and Gas Purpose:

- Two licences on Williston Lake for Oil & Gas Purpose, C133155 to Cambrian Energy Inc. (2016.04.29) and C133692 to Canadian Spirit Resources Inc. (2017.03.16). No sub-purpose is written on the licence. No storage purpose is associated with these licences.
- C133150 issued on the Beatton River to Black Swan Energy Ltd. for Oil & Gas (hydraulic fracturing and drilling) Purpose and Storage (non-power) Purpose, (on 1016.04.29). This licence has two different points of diversion with the above

purposes given for each location. The licence says “...storage is in dugouts.” No dugout locations are specified in the licence although the licence is appurtenant to various Natural Gas Leases “...all within the North Montney Regional Field, in the Peace River District.”

- C132372 issued on the Pine River to Canadian Natural Resources Ltd. for Oil & Gas: Hydraulic Fracturing (non-deep groundwater) Purpose and Storage (non-power) Purpose on 2017.01.17. Again, “...storage is in dugouts.” Similarly, no dugout storage locations are specified and the licence is appurtenant to “...oil and gas activities associated with various Petroleum and Natural Gas Leases ..., in the Septimus regional field, in the Peace River District.”

The reason for putting a subset purpose on the face of the licence primarily is to make it easy for the licensee, the Comptroller of Water Rights and the administration clerk to understand the basis on which the fee is calculated and to ensure the proper fee is charged.

In the licences above, the licence held by Cambrian Energy Inc. simply says “Oil and Gas Purpose”. However, the purpose in the water licensing data base states: “**O&G: Hydrlic Frctrg (Non**”. This is interpreted to mean Oil and Gas purpose, sub-set purpose of hydraulic fracturing using other than deep groundwater. Certainly when the source is clearly surface water, it is easy to interpret that it is “other than deep groundwater”. It is not possible to interpret from the licence whether or not the licensee is using water for drilling or hydraulic fracturing and it is probably both. However, the fee is the same for both activities so the distinction does not really matter. “Drilling” is still in the regulation as a subset purpose because this use for water pre-dates hydraulic fracturing in British Columbia and there are still some valid older licences that state the purpose for the water use is: “drilling”.

In the first two licences above, the licensee will draw water directly from Williston Lake. No storage purpose is authorized but water must be stored somewhere before it is used unless they are running water directly into the wells, which is unlikely. If water is being stored in dugouts, they are unauthorized and they need to be brought into compliance.

Also of concern is the blanket statement in the subsequent three licences that “storage is in dugouts.” Normally licences are appurtenant to the location where the water is used. The four licences are appurtenant to the undertaking of the licensee on various Petroleum and Natural Gas Leases, which is fine as far as it goes. If the dugouts are all constructed on the Leases, then this licence authorizes them (possibly subject to the *Dam Safety Regulation*, see below). However, if the dugouts are on Crown land off the Petroleum and Natural Gas Leases or if they are constructed on private land off the Leases, then they are not authorized by the above licences. In some cases, the gas producers have been issued Crown land leases by the OGC for the construction of storage. The water licences for storage purpose need to be linked to the “point of storage” on these Crown land leases or it is not possible to determine which dugouts are associated with licences and which are not.

If the dugouts include a dam, the dam must be classified and assessed. If water is stored behind a dam, the storage must be authorized.

Outstanding applications include:

- Thirteen applications made by Progress Energy on different sources, each one listing the intended purposes of Oil and Gas Drilling, Oil and Gas: Hydraulic Fracturing (Non-deep Groundwater) and Storage: Non-Power (all on 2016.12.23).
- One application by ConocoPhillips Canada Resources Corp. for Oil & Gas: Hydraulic Fracturing (Non-deep Groundwater) Purpose and Storage: Non-Power Purpose on 2016.06.06.
- One application by Encana Corporation for Oil & Gas: Hydraulic Fracturing (Non-deep Groundwater) Purpose and Storage: Non-Power Purpose on 2016.06.06.

Dugouts Filled by Groundwater

With the exception of an assertion of vesting groundwater in the Crown and some required qualifications for water well drillers and water well construction standards, there was no regulation of groundwater prior to the proclamation of the *Water Sustainability Act* on February 29, 2016. Now, groundwater and surface water are treated similarly with respect to licensing and regulatory requirements although there are some important differences.

Under the WSA, except for the exception in Section 6 discussed under Small Domestic Dugouts above, a person must not divert water from an aquifer without obtaining an authorization or acting under the Regulations. In order to fill a dugout from a well, a person must be qualified, must follow the regulations for well construction and must apply for a licence or use approval.

However, there are some Transitional Provisions that apply. Section 55 (1) of the WSR states “A person to whom section 140 (1) of the Act applies must apply on or before March 1, 2019 for an authorization authorizing the person’s diversion and use of water from an aquifer.” Section 140 (1) of the WSA states “Despite Section 6 (1) [*use of water*], a person who, on the date section 6 comes into force, is diverting or using, including storing, water, other than as described in section 6 (4) [*use of water – excluded groundwater users*], from an aquifer for a water use purpose may continue to divert, store and use water from that aquifer for that purpose as follows:

- (a) if the person applies for an authorization on or before the date that applies to that person by regulations under subsection (2)(c), until the date a decision is made on the application;
- (b) if the person fails to apply for an authorization on or before the date that applies to that person by regulations under subsection 2 (c), until that date.

So, to summarize, a person who is currently using water from an aquifer, including storing the water in a dugout, can continue to use and store that groundwater but must apply for

a licence before March 1, 2019 and may continue to use and store the water until a decision is made on the application. If the person fails to apply for a licence for using and storing water, he or she may continue to use and store water only until the end of February, 2019.

If the groundwater storage dugout includes a dam, however, it must be classified and assessed. If it is a Part 2 dam (see below), it must be licensed now.

As an incentive to apply early, Section 55 (3) states: “Despite section 12 (1)(b)(ii) [application and decision maker initiative procedures] of the Act, if an application under subsection (1) of this section is received on or before December 31, 2017, the applicant is exempt from the requirement to pay an application fee.” This means the application fee was waived until December 31 this year

A person who constructs a well must (Sec. 49 (1)) comply with the regulations and be either a qualified well driller (49(2)(b)(i)) or acting under the direction of a qualified well driller or a competent professional (49(2)(b)(ii)(A) or (B)).

Dugouts Filled from “Indeterminate Sources”

Naturally occurring wetlands are sometimes found at the base of a hill. Usually the wetland is caused by a spring of upwelling groundwater. In the past, these have been dug out and a berm has been created which forms a constructed water storage structure with no diversion into it. The writer knows of cases where these sorts of structures have been licensed where the source is named as a “spring” and diversion and use from there has been authorized.

Rain falls out of the sky, sometimes even as much as 100 mm or 150 mm or more in a day but that would not fill a dugout from just falling into it. If a dugout filled from runoff from a hillside, there would probably be a channel created and then it meets the definition of a stream. Even without a channel, the WSA defines “**stream**” in Section 1 to include:

- (a) a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel has been modified, or
- (b) a natural source of water supply, including without limitation, a lake, pond, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer.

Certainly “overland flow” or un-channeled runoff is sometimes called, could be a natural source of water supply. It is difficult to offer advice on this situation because it would so much depend on the facts, but if water is being captured and put into commercial use, it probably needs to be licensed.

If there is a dugout filled with water and there is no surface water diverted into it, no groundwater being pumped into it and no historical record, aerial photograph, or satellite image of a wetland or spring being there before the structure was built, then the water was probably transported there. And if there is a road right up to it and a good place for emptying a tanker truck into it, the water was probably hauled there in trucks.

Can such a structure be licensed and should such a structure be licensed?

Dealing with these questions requires looking to the WSA which, in Section 1 defines “works” and is repeated here in full as follows:

“works” means

- (a) anything that can be or is used for
 - (i) diverting, storing, measuring, conserving, conveying, retarding the flow or, confining or using water,
 - (ii) producing, measuring, transmitting or using electricity,
 - (iii) collecting, conveying or disposing of sewage or garbage, or
 - (iv) preventing or extinguishing fires.
- (b) booms and piles placed in a stream,
- (c) obstructions placed in or removed from streams or the banks or beds of streams
- (d) changes in and about a stream,
- (e) access roads to any of the works referred to in paragraphs (a) to (d) or
- (f)(i),
- (f) wells and works related to wells, including
 - (i) wellheads,
 - (ii) anything that can be or is used for injecting or otherwise adding water or any other substance to a well,
 - (iv) anything that can be or is used for exploring for, testing, diverting, or monitoring groundwater.
 - (v) anything that can be or is used for disinfecting a well,
 - (vi) an injection system attached to a work that is used for conveying, from a well, groundwater that will be used for applying fertilizers or pesticides, and
 - (vii) anything that can be or is used in relation to a monitoring well or a well made for the purpose of groundwater remediation.

The definition in (a) “anything that can be used or is used for (i) diverting, storing, measuring, conserving, conveying, retarding the flow or, confining or using water” is enough on its own to capture a dugout that is used to store water before transporting the water further to its point of use provided it not within the sections 6 (3) and 6 (4) exemptions for domestic use. If these are large dugouts with the water destined for hydraulic fracturing, the domestic use exemption does not apply.

The entire definition was repeated here to show how broad and all-encompassing it is. Surely the Legislature’s intent was to make the powers broad enough and encompassing enough to capture a dugout filled with water for the oil and gas industry. If the Legislature had intended these not to be regulated, it would have said so in the regulations. The *Water Sustainability Act* specifically provides for exemptions for small domestic dugouts. The *Water Sustainability Regulation* provides exemptions from licensing requirements of Section 6 (1) of the WSA in WSR Sections 31 through 35

respectively for corridor drainage, local government drainage works, agricultural drainage, building perimeter drainage, and drainage wells, provided in every case that “...there is no use of water for a water use purpose...” No exemptions have been made for large commercial, industrial or oil and gas supply dugouts. If the Legislature had wanted these dugouts to be exempted from regulation, they would have provided for the exemption. A dugout is “works” under this definition and it has not been exempted.

It **should** be authorized under the legislation.

The *real question is “How can it be licensed?”* The Water Sustainability Regulation specifies in Section 3 (1) the information that must be provided on an application for an authorization such as a water licence. Among many other things, it is required to provide the source, whether stream or aquifer, from which the water is proposed to be taken. Knowledge of the source is essential in a making an authorization decision as two of the principle requirements imposed on the decision maker by the legislation is to protect the rights of other users of the water and protect the aquatic environment from which the water is proposed to be taken.

Some gas producers have indicated that they want to build or have built dugouts to store water close to the gas field. They fill the dugout with water authorized under various use approvals that they have obtained for different sources depending on access to the source, road restrictions and availability of water at the source. Protection of the environment and of other’s rights are assessed when the use approval decision is made. These things must be assessed again if the use approval is renewed. If water for hydraulic fracturing is stored in a dugout in proximity to the gas leases and the source of the water that is put in the dugout is taken from various sources and hauled by truck to the dugout, then the water licence should provide for or exclude and prohibit this use.

This writer has long opposed issuing a use approval again and again for the same use at the same place. If a source is going to be used for a number of years, a water licence should be issued for the length of time the water is required. However, often producers want to move from source to source depending on conditions.

Could a storage licence be issued authorizing filling from various use approvals?

Any government document worth writing must be written in such a way that both government and recipient are clear on what is being authorized. This protects the licensee and allows government to both protect the licensee’s rights and enforce the terms if they are violated. To do this, a storage licence must list the source of the water and must also state the purpose for which the water is being used, the place the water is being stored and the place of use to which the licence is appurtenant.

A water licence could be issued appurtenant to the undertaking of the gas producer on various Natural Gas Leases (which should be listed on the licence or on a Schedule A to the licence). The “point of storage” should be shown as on the Crown land lease or gas lease (this must be the actual place where the dugout is constructed) and the source could be from various sources. However, to licence a dam there must be a primary source of

water that is under a water licence authorizing diversion from that source. A long-term infrastructure and landscape change to create a large dam is incompatible with the concept of a short-term use approval. This is the reason that a dam cannot be authorized by a use approval. Some water taken from a short-term use approval could be stored behind this dam as well. Not every bucket of water can be traced from source to use this way but at least the dam will be tied to its major source of water under a licence.

Dugouts that are Dams under the Regulation

The *Water Sustainability Act* has three regulations associated with it that are all of importance to dam owners. These are the *Dam Safety Regulation* [BC Reg. 40/2016], the *Water Sustainability Regulation* [BC Reg. 36/2016] and the *Water Sustainability Fees, Rental and Charges Tariff Regulation* [BC Reg. 151/2016].

The *Water Sustainability Act* does not define a “dam”. However, under the definition of “works” shown above in its complete form and shown in part here:

“**works**” means

- (a) anything than can be or is used for
 - (i) diverting, **storing**, measuring, conserving, conveying, **retarding the flow** or, **confining** or using water, [*Emphasis added*].

It is clear and intentional that the definition of “works” includes a dam.

The *Dam Safety Regulation* (DSR) defines a “dam” as”

“**dam**” means

- (a) a barrier constructed for the purpose of enabling the storage or diversion of water diverted from a stream or and aquifer, or both, and
- (b) other works that are incidental to or necessary for the barrier described in paragraph (a);

From this definition, it is clear that any structure that includes a dam, berm, retaining wall, or other barrier for confining and storing water is a dam under the DSR. Thus, the DSR will have application to certain dugouts that have berms or dams associated with them for retaining water from a stream or aquifer.

Section 2 (1) of the DSR describes a **Minor Dam** as being a dam that meets both of the following criteria:

- (a) the dam is less than 7.5m in height;
- (b) the dam is capable of impounding at full supply level a maximum total storage volume of water in the reservoir of the dam of 10,000 m³ or less.

Minor dams are exempted from the requirements of the DSR except where the comptroller or a water manager orders that this regulation applies if the comptroller or water manager is satisfied that the dam is or may become potentially hazardous to public safety, the environment, or land or other property.

All dams except minor dams must comply with Part 2 of the DSR.

Large dams or dams with a significant or higher consequent classification must also comply with Part 3 of the DSR. Regulatory requirements for Part 3 dams are more substantial as might be expected. Part 3 applies to a dam if it:

- exceeds 1 m in height and is capable of storing more than 1,000,000 m³;
- exceeds 2.5 m in height and is capable of storing more than 30,000 m³;
- exceeds 7.5 m in height regardless of volume; or
- has a consequence classification of significant, high, very high, or extreme.

It should also be noted that all dams that are unclassified are deemed to have a classification of “significant” and Part 3 requirements would apply (Section 3 (5)). The classification remains the more severe of either “significant” or the one proposed until the Dam Safety Officer gives notice of the classification.

It is not the purpose of this report to discuss the requirements on dam owners for construction, maintenance, surveillance and decommissioning of a dam. However any dugout that is filled from a surface source or groundwater and that has a barrier or berm above the natural ground level that is holding back water **is a dam**. All non-exempt dams must be classified and owners are required to know the law and regulations that govern their dam and owners must comply with those regulatory requirements.

Dam Safety is the responsibility of the dam owner. FLNRO has Dam Safety Officers (DSOs) who get referrals on applications for authorizations that have dams proposed. The DSOs are required to approve proposed classifications of all new dams, they consult with dam owners and respond to public questions. They audit the operation, maintenance, surveillance, and emergency response plans of dam owners and receive regular reports from dam owners. They may observe new dams while under construction, and they run safety audits on dams. They are an important safety check to help ensure public safety.

The most recent report on DSO workload is found in the 2014/15 Dam Safety Program Annual Report:

From: 2014/15 Dam Safety Program Annual Report									
	Victoria	West Coast	South Coast	Thompson	Cariboo	Okanagan	Kootenay	North	Total
Failure Consequence Classification									
Extreme	36					2			38
Very High	45	4		3	2	2	7		63
High	62	26	16	55	32	12	47	3	253
Significant	64	92	29	150	82	23	74	55	569
Low	5	65	9	98	259	33	39	178	686
Unclassified	4	1	1	4	21		2	13	46
Total	216	188	55	310	396	72	169	249	1655
DSO FTE's*	3 FTE	1 FTE	0.1 FTE	1 FTE	1 FTE	1 FTE	1 FTE	1 FTE	

* Some regional DSO's also have flood safety or authorization responsibilities so may not be 100% on dam safety

Table 2: Dam Safety Officer Workload

Currently, FLNRO has only one DSO in the entire North Area, based in the Prince George office. The workload includes dams in the Northeast, Omineca and Skeena Natural Resource Regions. It is the second largest workload in the Province in an area that includes half the Province. There are at least 80 new dams, all unclassified, that will be

regulated dams in the Northeast area and the number could be 200 or more by the time the assessment is done. It is unreasonable, or at least very risky to expect one DSO to handle this additional workload. As of this writing it is believed that the Oil and Gas Commission has one individual appointed as a DSO. Nevertheless, this is not sufficient to take on the classification of the dams as well as the on-going work that will be required (See Recommendation # 7).

Authorization Requirements Summary

Under “**Use of Water**” in the WSA, Section 6 states:

- 6 (1) Subject to this section, a person must not divert water from a stream or an aquifer, or use water diverted from a stream or an aquifer by the person, unless:
- a) the person holds and authorization authorizing the diversion or use, or
 - b) the diversion or use is authorized under the regulations.

Subsection 2 allows for using water for firefighting or water testing without further authorization. Subsection 3 allows diversion from a stream for domestic use and prospecting and from an aquifer for prospecting. As discussed above, Subsection 4 allows diversion and use, including storing, groundwater from an aquifer for domestic purpose, with some exemptions.

For any use purpose then, use is not allowed without a use approval or a licence except domestic use, firefighting and prospecting (a defined terms in the Act). Storage of groundwater for domestic use is permitted without a licence, but storage of surface water is not (see Recommendation #12).

The Dam Safety Regulation applies if there is a barrier above ground such as a berm or dam that holds water back. This applies even if the storage contains groundwater for domestic use and is thus permitted under Section 4 of the WSA.

The *Water Sustainability Regulation* (WSR) Section 3 states:

- 3 (2) A decision maker must not authorize in a use approval water storage by a dam to which Part 2 of the Dam Safety Regulation (DSR) applies unless the dam is authorized by a licence.
- 3 (3) An application for a licence or, subject to subsection (2), a use approval, that proposes storage of water by a dam must include all of the following information, as applicable:
- (a) the height or proposed height of the dam;
 - (b) the length or proposed length of the dam;
 - (c) the crest width or proposed crest width of the dam;
 - (d) the maximum volume of water proposed to be stored by the dam.

A minor dam could be authorized in a use approval but no Part 2 dam can be authorized by a use approval. But even authorizing a minor dam in a use approval is bad practice in most circumstances. Use approvals may only be valid for up to two years. Yes, the approval may be renewed but if it is not, the dam would have to be removed or rendered unable to impound water. Better practice is to ensure that even minor dams that have a significant capital cost are covered with a licence.

4. COMPLIANCE AND ENFORCEMENT APPROACH

There is a common process for enforcing legislation or implementing new legislation. Here we are dealing with a combination of both enforcing the existing water legislation from the former *Water Act* and implementing the new elements of the *Water Sustainability Act* that came into force on February 29, 2016. In addition, we are seeing the impacts of accommodating a relatively new to British Columbia industry of natural gas development.

The standard approach has 5 steps:

1. Observation and Information Gathering
2. Awareness and Education
3. Seeking Compliance
4. Enforcement
5. Monitoring

Each is discussed below.

Observation and Information Gathering

This step involves gathering information and determining the degree of compliance with the legislation that is taking place. With the relatively large size of dugouts, it is expedient to use satellite imagery today to discover the size and location of dugouts in the area of concern. This has largely been done and is discussed in Section 2 above. Airborne and on-ground inspection will be required in many cases. This can be combined with information about the current water licence records and the outstanding applications to see what the level of compliance is.

Awareness and Education

For people to comply with legislation, they must be aware that it exists and know that it applies to their activities and they must understand what steps they need to take in order to be in compliance with the legislation. As has been pronounced many times in the courts, ignorance of a law is no excuse for breaking it. Nevertheless, it is incumbent on the government to make people aware of the legislation and changes to legislation that bring in new requirements. The Ministry of Environment held some workshops in the Northeast Region to update the public about the February 29, 2016 change in requirements for licensing groundwater in the *Water Sustainability Act*. The Ministry advises that they “...have reached out to existing users through a number of channels,

including distributing over 65,000 information brochures.” They have also “...advised local and First Nation governments, improvement districts and sector organizations through emails, meetings, presentations and conference calls.” Further workshops are also being planned to assist agricultural and other producers with the application process.

Oil and Gas Commission staff have contacted all their gas producers in the area and advised them of the requirements. The OGC has also produced an information bulletin on the Dam Safety Regulations which is very helpful. Further, the OGC has surveyed all their producers with respect to their water sources and is encouraging compliance with the legislation. This has led to a number of petroleum companies making water licence applications.

In spite of this work, the level of understanding of the requirements within the Northeast Region is not very high based on anecdotal evidence and observations of staff. More outreach in a targeted fashion is required with respect to dugouts, especially those dugouts that are deemed dams by the legislation.

Seeking Compliance

The most efficient approach, the one that makes the fewest demands on government, is to encourage people to comply voluntarily with the legislation. Sometimes a transition period is provided as has been done with the implementation of the requirement to licence ground water use. The degree to which enforcement action is used to ensure compliance is a policy decision and is discussed below.

Government will need to agree on a Compliance and Enforcement Policy for seeking compliance and for undertaking enforcement. The Ministry of Environment, the Ministry of Natural Gas Development, the Ministry of Forests, Lands and Natural Resource Operations, and the Oil and Gas Commission must agree on this policy approach to compliance and enforcement. The Ministry of Agriculture and the Agricultural Land Commission must be consulted in the creation of this policy, especially with regard to the issue of where and when dugouts are non-farm use and what compliance and enforcement activities will be undertaken with respect to large water storage structures built by private owners within the Agricultural Land Reserve (Recommendation # 15).

FrontCounterBC has developed detailed step-by-step guidance on how to complete an application to license groundwater. Information such as this and also information about dugouts and the pertinent regulations should also be carried by the field inspectors who can give the information to property owners and advise them as to what they must do in accordance with the policy. A simple information bulletin on application requirements for storage sites and owner responsibilities under the Dam Safety Regulation (similar to Industry Bulletin 2016-26 produced by the OGC) would also be very helpful.

It is suggested that Large and Very Large dugouts be assessed first and, where appropriate, brought under licence. Medium dugouts will be needed to be assessed as well as a second

priority. Due to the lack of information about volumes stored and lack of three dimensional views of dugouts, it cannot be known if the plethora of small dugouts pose any risk or might require licensing. These small dugouts are a third-level priority and should be the target of an information campaign for owners to self-assess.

It may be necessary to ensure the safety of some structures be improved by the installation of a spillway or some improvements in the construction. In some cases, if adequate design and construction cannot be demonstrated and there is a risk to life and property from a failure, it may be necessary to have the structure drained and breached so it cannot hold water again until it is reconstructed in an appropriate, approved manner with proper design and construction methods. The compliance policy should provide some direction in these situations to ensure consistency in approach.

Enforcement

Not everyone will voluntarily comply. The Compliance and Enforcement Policy should state how and under what circumstances enforcement action will be taken.

In the case of surface water, a licence has been required for a very long time for anyone to divert a stream and store the water. While it is suggested above that the recommended approach is to bring these people into compliance, it is also recommended here that if surface water has been diverted without a licence, the diversion should be examined to see if there has been environmental damage or on-going harm caused to habitat or if there has been an infringement on the rights of others who are licensed to divert this water. In such cases an administrative penalty might be appropriate (Regulations not yet in force) and a decision has to be made whether the structure could possibly be licensed or not. If not, then an order can be issued to have the structure removed and the damage mitigated. If a licence might be possible, then an order can be given to stop diversion until such time as a licence is issued. Another order could also be given to make any safety or other improvements as might be necessary. All orders must specify timelines for compliance and all orders must be followed up to ensure compliance.

The *Water Sustainability Act* has many compliance and enforcement powers. Section 89 provides right of access to land by authorized persons (includes comptroller, water manager or engineer and persons working under authority of same). The comptroller and water managers have authority to order actions to be taken if necessary (Section 91). The comptroller has authority to authorize actions by the government or another person if a person fails to do a thing when ordered to do so (Section 91). Engineers and officers (includes comptroller and water manager under Section 114) have authority (Section 93) to inspect works and land and to direct “orders” to a person with respect to works, whether or not the works are authorized and whether or not an authorization is required.

Rights granted under approval or licence may be suspended or cancelled under a wide range of circumstances (Section 94).

Power to take action in accordance with the regulations by way of administrative monetary penalties is given to the comptroller in Section 99 where a person has contravened a prescribed provision of the Act, failed to comply with an order under the Act, or failed to comply with a condition of an authorization, change approval, permit or drilling authorization. However, no *Administrative Monetary Penalty Regulation* has yet been written. Under Section 102, the comptroller, in accordance with any applicable regulations, may enter into an agreement with a person to suspend an administrative penalty where notice is given in return for remediation of adverse impacts or other mitigation. These sections may be useful for compliance action after the Regulations are in place.

Offences are catalogued in section 106, including among many others, an offence to

- 106 (3) (j) construct, operate or use works for diverting, storing or using water, which works
 - (i) are not authorized by the person's licence, use approval, change approval, permit, or drilling authorization or by another enactment, or
 - (ii) are not constructed, operated or used in accordance with any applicable regulations.

There are also "high penalty offences" (Section 107) and a provision for "creative sentencing" (Section 109).

Enforcement should only be done if necessary; but if it is necessary, it should be done as soon as possible and it must be followed up. The Compliance and Enforcement Policy for dugouts should spell out for the field staff who to contact when they encounter a situation that requires enforcement and what action they and others should take.

Monitoring

With the initial assessment done, information handed out, owners advised and perhaps ordered, enforcement action taken, the job is still not done. It will take time and diligence to finish this work. All enforcement actions must be followed up. Requests for compliance must also be followed up. For example, if someone was advised they needed to apply for water licence or they needed to register their groundwater well, that needs to be logged, tracked and followed up.

5. RECOMMENDATIONS

Using the standard approach to compliance discussed above as a framework, the following steps are recommended. The recommendations are grouped under the compliance framework headings and they are numbered for convenience, however, neither the headings nor the numbers imply a strict order of steps to be undertaken. This is discussed more fully below in Section 6, Work Planning,

Observation and Information Gathering

1. **Create a senior-level Steering Committee.** At a minimum this is an ADM from the Ministry of Forests, Lands and Natural Resource Operations and a Deputy Commissioner from the Oil and Gas Commission. Involving the policy ADM from Environment is not a bad idea. The Steering Committee should begin by assigning the accountability for this project to the director-level people in the both the authorization groups and the compliance and enforcement groups in FLNRO and the OGC. The Steering Committee will direct that this work get done, will assign adequate resources, both human and financial to the project, define milestones for deliverables, and require progress reporting. Further, it needs to align the work of the two agencies, assuring a common purpose and staff cooperation. This Committee will also ensure no Minister gets surprised and that the local MLAs are apprised of actions being taken.
2. **Create a Dugout Database** in appropriate software. This may already exist as part of Bevington's work although his purpose was exploratory and the purpose of this new database is administrative. The database should be able to contain the information listed below and should be searchable. It can be used for workload management as well as compliance determination. This does not need to be and should not become a big, complicated project. It is a pretty small database but it should be very useful.
 - 2.1. Give a **Number** to each of the 7,990 dugouts and populate the database. The database should have a field for the **type** (AG, MU, EX, or OG) and the size (SM, MD, LG, and VL) and **area** if the calculation is done. A **location** needs to be specified, probably latitude and longitude of the center of the dugout. A field should be provided for **ownership** information, probably name, address and phone number of the registered owner and **cadastral information** (legal description of the land unit holding the dugout or a notation that it is Crown land or and Oil and Gas lease). Fields in the database are also needed for licence status (is a water licence required? Y or N; if yes, has it been applied for? Application number? File number? Etc.).
 - 2.2. Create space in the database to flag if there is a **dam or berm** associated with the dugout. If so, there needs to be fields for height, crest width, and volume. Provide a comments space for free-form comments on condition, observations of seepage or slumps, etc.
 - 2.3. Create a field for a **Responsibility Center** in the data base and populate it as the center is determined. This will indicate which office holds responsibility for managing any action required for this dugout (inspection, licensing, enforcement, etc.).
 - 2.4. **Create fields for Action.** Log here whether the dugout has been assessed by a staff person and ensure fields for assessor's comments. Log here any advice given (such as advising a landowner to apply for a water licence, any orders issued, or

any enforcement action taken. Provide for follow-up action to be entered and provide for a “completed” notation to be entered. Note that this database is not intended to replace either e-licensing or the dam database. If a dugout needs a licence, once that licence is applied for, the action status is “completed” here and the dugout becomes a water storage structure managed through e-licensing.

3. **Determine land ownership** by applying the location information of each dugout to digital cadastral information to see if the dugout is on Crown land, leased Crown land, or private land and to determine the legal description and ultimately the owner of the land or lease. Dugouts that are proximal to streams can be identified and dugouts that have drained (possibly breached) may also be identified. Enter this information into the database.
4. **Determine a Responsibility Center for each dugout.**
 - 4.1. Contact the **Oil and Gas Commission** to determine which dugouts they are managing and to get their information into the database. They will be the responsibility center for those dugouts.
 - 4.2. Liaise with the **Dam Safety Section** in Victoria to determine if they will manage any of the dugouts with berms or dams of a major size. They may become the responsibility center for some of the dugouts.
 - 4.3. Determine where responsibility lies for the remaining dugouts (e.g. FLNRO office in Prince George, Fort St. John or Fort Nelson.)
5. **Create an Administrative Team** in one of the responsibility centers. Fort St. John is the recommended place as it seems to be the center of the greatest activity. Start with 3 people: 1 full-time clerk who will populate the Dugout Database and then will handle incoming water licence applications, 1 clerk who will work part-time initially on the database and then will assist with workload, and serve as back-up to the full-time position; and 1 technician who will be part-time with the administrative team and part-time a field technician. The role of the technician in the Administrative Team is to provide advice and interpretation of the incoming information. This technician must be, or become, familiar with the working of the Dugout Database. The technician role could rotate among available technical staff to learn about the database and provide advice on different areas of the province. The team should also be, or become, competent in the use of the Water Licensing data system.
6. **Recruit a water manager for the Fort St. John office.** This person should be a senior technical person (ideally an engineer) who can provide leadership to the water staff including making authorization decisions on complex files as well as giving technical support to the other staff. The water authorizations staff in Fort St. John are relatively new and inexperienced in water licensing matters. They are capable of growth but they need in-house, senior level advice, support and direction.

7. **Immediately recruit and train 2 new Dam Safety Officers for the Fort St. John office.** It takes time and training to become proficient in the role of a DSO. It is recommended that two be recruited and trained. It may be that in the longer term (3 to 5 years hence) the workload may be manageable by one DSO in the OGC and one in the Fort St John office. However, it will take more than three years to complete the classification of all the dugout-dams that are suspected to exist and to bring all the dams thus identified and classified into compliance.
8. **Share the “OG-type Dugout” Information with the Oil and Gas Commission (OGC).** Ask the OGC if they are aware of these dugouts. Can they confirm that they are on gas leases or Crown land? Are they in the process of licensing any of them
9. **Share the entire Dugout Database with the OGC.** Ask them to review location information and identify any dugouts that are on gas leases or Crown land leases for water storage. ? Are they also looking at licensing other dugouts that are not in the OG Dugout list? Put the information into the database.
10. **Negotiate a protocol with the OGC for dugout responsibility and dugout assessment on gas leases.** This protocol needs to clearly identify which agency is responsible for managing the dugout, and which will do the assessment and which will carry out subsequent actions. Reporting to each other with respect to assessments and follow-up action is important and should form part of the protocol. Agency response times must be similar as well.
11. **Investigate and discuss joint assessments with OGC staff.** This is advantageous for training purposes and to ensure consistency in response across both agencies. The public will not tolerate a different “deal” for OGC clients than farmers can get.

Awareness and Education

12. **Create public messaging** prior to any activity to assess dugouts. The actual messages will depend on the policy choices made below. The intent of the messages is to let people know that there will be some activity looking at dugouts. The secondary intent of the messaging is to prevent a public uproar based on misinformation. The messaging should highlight the safety concerns and also discuss compliance with the legislation. Not all dugouts will need to be licensed. In fact, most using groundwater will fall within the exceptions provided in the legislation. More could be safely exempted. For those dugouts that need licences, fees are modest as most dugouts will fall within the requirement to pay a minimum fee.
13. **Seek a regulation to exempt small dugouts** that do not include a dam and are filled with unrecorded surface water from streams not frequented by fish. Make the regulation as similar as possible to Alberta’s exemption from the requirement for obtaining an approval for dugouts storing less than 2,500 m³. It will be simpler for both industry and agriculture if these exemptions are as near as possible to being the

same, given the workforce movement both ways across the provincial borders. The exemption could be restricted to water used for domestic or agricultural purpose or it could be restricted to be for water use on site use only.

14. **Communicate inside government about the Dugout activities.** Some dugouts might be on Crown land. They may be unauthorized or they may be used by Forests for fire-fighting, or they may be part of a mine operation. Ducks Unlimited (DU) has partnered with many private landowners and with some government agencies to do waterfowl habitat enhancement. DU generally makes sure their activities are licensed but it is worth asking the question. Colleagues in government should be given notice of this activity and may also have information to share.

Seeking Compliance

15. **Create a government dugout policy for seeking compliance and undertaking enforcement.** The Steering Committee should begin by seeking legal advice and then meet with the Chair of the Agricultural Land Commission or the Vice-Chair of the North Panel or both, to determine how to deal with dugouts in the ALR. The Dugout C&E Policy should clearly explain government's intentions and should be used as the basis for public information materials as mentioned above. Suggested policy statements include:

- Government will be looking at many dugouts throughout the region.
- The primary purpose is to ensure public safety from dugouts that have a berm or dam as part of their construction.
- The secondary purpose is to ensure compliance with the *Water Sustainability Act* and other applicable government legislation and regulations.
- Government is not trying to stop the construction or use of dugouts but wants to ensure they are properly constructed and where necessary appropriately permitted and licensed.
- Owners of dugouts are responsible for the proper design, construction, maintenance, and operation of dugouts and may be required to have them licensed.
- Where dugouts have berms or barriers that constitute dams, government will enforce the legislation with regard to licensing and classification of dams.
- Government staff will provide advice on steps owners must take if a dugout appears unsafe or out of compliance.
- Government staff will not provide technical advice on how a berm or dam must be constructed. The owner is responsible for seeking appropriate advice from an engineer qualified to provide such advice.

- If a dugout presents a risk to lives or property and it cannot be operated safely without reconstruction, government staff will require it to be safely drained and breached until it can be properly reconstructed.

- 16. Seek to get Administrative Penalty Regulation completed and brought into force.** The current ticketing offence provisions results in small fines that are insufficient to change behaviour and the court proceedings resulting from charges are costly and time consuming. Administrative penalties have worked in other natural resource areas such a forestry and the *Water Sustainability Act* provides for them but the Regulation is not yet in place.
- 17. Directly contact owners of large dugouts that are unlicensed or for which there is no application in FLNRO or the OGC.** Names and addresses can be obtained from the Dugout Database. Owners should be notified in advance of any assessment team arriving at their property. Direct reference should be made to the dugout on the property. A satellite photo of the dugout could be included so the owner knows what the team is interested in.
- 18. Create a field assessment plan.** Use the satellite imagery and digital road maps to plan efficient routes. Plan to use a helicopter for a rapid assessment where this would be efficient and where size and location dictate the efficiency.
- 19. Create an assessment team or teams.** Two-person teams are required to do field work, looking at dugouts to determine if they present a risk to the public or property and to determine if they require a water licence.
- 20. Assess all 363 Large and 149 Very Large dugouts.** This is the priority for the dugouts that might pose a hazard to humans or property. These landowners will receive a mail out telling them that their dugout will be assessed. The OGC has already done this with most of their producers. It will be important to target the remaining landowners with mail out to advise them of an upcoming assessment.
- 21. Assess Medium dugouts that are easily accessible.** These are dugouts that are on the route to or are in close proximity to the Large or Very Large ones. These dugouts will also be subject to mail out to land owners.
- 22. Create a plan to assess the remaining Medium dugouts as time and resources permit over the subsequent years.** Because there is very little information about the depth of water or height of berm in satellite imagery, all except the small dugouts need to be looked at by eyes experienced in assessing public safety from impounded water.
- 23. Log all assessment findings into the Dugout Database** including comments on what was found, whether there was action required by the landowner with respect to safety, licensing, etc. and what follow-up action is required.

Enforcement

24. **Involve OGC and FLNRO Compliance and Enforcement Branches in assessment planning.** Suggest their participation in assessments. Determine an Enforcement Protocol for calling on C&E staff help in enforcement situations.
25. **Ensure assessment staff are all familiar with the Compliance and Enforcement Policy** and know what steps to follow when an issue needs to be escalated.
26. **Take enforcement action as necessary in accordance with the policy.**
Enforcement action should be required only rarely. But it will probably be required and when a public safety issue is known, it must be dealt with. If enforcement is required, it must be done.

Monitoring

27. **Prepare a monthly or quarterly report for the ADM.** Use the database to report statistics on dugouts assessed, action requested and actions completed. Report enforcement actions separate from advice and licensing actions. Share the quarterly report with the OGC and internally with senior staff. Celebrate success.

6. WORK PLANNING

The work planning that follows assumes that the recommendations (or at least most of them) will be acted upon. Much of the detail is given in the recommendations above. This section suggests an order and a time line for dugout management but it is not a complete work plan as much will depend on the findings of the proposed rapid assessment.

Three distinct phases are proposed for bringing dugout management into the normal processes of managing water use in BC. The first phase is “Preparation”. Secondly is a “Rapid Assessment” to discover and deal with any hazards to life and property from improperly constructed dugouts and begin the process of getting dams into the E-licensing system and the dam database. The third phase is “Normalization” or bringing the regulation of dugouts into the normal process of authorizations for water use. The fourth stage is “Normal Operations”, where the regulatory requirements of dugouts are understood by all owners, they are authorized by licence where necessary, and dugouts are just part of the continuing workload of water management in the northeast.

Preparation

This stage should be completed in 3 months: April through June, 2017, inclusive.

Commence by sharing this report with the Steering Committee members and senior Directors who will be involved in the Dugout project. The first steering committee meeting can then be used to agree on cooperation, determine if the approach presented here is reasonable and assign responsibility to senior directors for the task proposed. As

soon as possible after commencement, responsibility and resources must be given and accountability assigned.

The Oil and Gas Commission already knows about many of the dugouts that have recently been built by petroleum companies and they know that the owner-builders of these structures are having them assessed by competent engineers. It is probable that these can be left to the companies and the OGC to bring into compliance. However it may be advisable to have a trained dam safety officer visit each site.

During this period, the Administrative Team should be either recruited or seconded. The Dugout Database should be created and populated. The Administrative Team should be charged with doing the data entry and working with in-house or contract database experts, designing both data-entry screens and reports that will be used with the Dugout Database. Further GIS work can be done to locate the Medium, Large and Very Large Dugouts on a cadastral database and determine land ownership.

Those dugouts that are known to the OGC and are under their mandate can be marked OGC responsibility in the database. Ultimately, all Type 2 dams that are discovered need to be entered into the Dam Database that already exists and if a licence is required, they should be entered into the E-licensing system. Any minor dams that are being filled with surface water diverted unlawfully or groundwater that will need to be licensed but for which a licence is not thought to be required should also be entered into E-licensing.

A Communication Plan will be needed with target audiences identified, messaging approved, media determined (mail out, newspaper, on-line, local radio, etc.), and timing chosen. The launch sequence looks something like this:

- Government spokesperson identified.
- Ministers and MLAs briefed (personal, verbal).
- Provincial and local governments notified (mail out, telephone).
- Land owners notified (mail out).
- Media alerted (news releases).
- Spokesperson available for interview.

By mid-June the Rapid Assessment Team should be identified. This is a good time to do some further dam assessment training and final logistics need to be down, with routes planned, timing nailed down, team members assigned, transportation arranged (helicopter, trucks) and lodging booked. New staff (Recommendations # 5, 6, and 7) should be on-board by the end of this period of preparation. It is also necessary to second a senior Dam Safety Officer (or a rotating series of DSOs from other regions) to participate in the rapid assessment phase below.

Rapid Assessment

This stage should be completed in 3 months: July through September, 2017, inclusive.

A Rapid Assessment was done of dams in British Columbia following the failure of the Testalinden Dam in 2010. The expertise of the people who participated in this assessment would have valuable knowledge that could be used to help organize this rapid assessment stage.

All 363 Large dugouts and 149 Very Large dugouts need to be assessed. It is important that this work is coordinated with the OGC. Some, perhaps many, of these dugouts are being used to supply water for hydraulic fracturing. The OGC should know which of the dugouts that their producers have notified the OGC about are on the dugout list. Responsibility for assessment of each dugout must be determined. Some joint assessments are highly recommended both for training purposes and to ensure consistency of approach and follow-through of the assessment process. Any uncertainty as to which agency is responsible for a dugout can be resolved through a joint assessment or some form of reporting and coordination.

The Rapid Assessment is primarily an airborne helicopter exercise. The intention is to find the dugout from the locations in the database. Fly around it, photograph it. Make a few notes. Is the size in the database approximately correct? Is it obvious how the water gets into it? Is there a berm or embankment that would mean it would be a dam under the Regulation? What is down-slope that affects the consequence classification? Finally, are there any conditions that appear to present an imminent or urgent safety hazard? Only in a case requiring urgent action might a decision be made to land. Mostly, a follow-up notation will be made and then fly on to the next one.

There are over 3,000 Medium dugouts: **1,410** in the Fort Nelson District and **1,782** in the Peace District. While the rapid assessment is under way, a mail out should be done to the owners of the Medium dugouts. The mail out should have a questionnaire with questions regarding the nature of the dugout (dam or not, length, width, depth, purpose use of the water, etc.) to be returned in 30 days. The package should also contain information about the responsibility of a dam owner and the need for licensing if appropriate. It is helpful to include a phone number for owners to call and discuss their dugout. This should be a dedicated number for this purpose only. Different people in the office can take turns answering this phone. A script should be prepared to answer the expected questions. It may be possible to have the information taken by a staff person if the dugout is entirely in the ground.

Early in this period would be a good time to complete and announce a regulatory change with respect to small dugouts using surface water (Recommendation #13).

Once it is freezing at night and the snow starts falling, it is very difficult to do a thorough assessment of the safety of a dam.

Normalization

This stage begins in September, 2017 and continues through to the end of March, 2018.

Over the winter, there is licensing work that will continue. The work will include dealing with the incoming water licence applications and making decisions on them. Applications require both administrative processing and technical investigation. It is important that people who respond to government's requirement to obtain a licence are given timely responses to their correspondence. The only way to assure this is to have a dedicated team working on the applications with adequate resources and to ensure that a senior manager (Recommendation # 6) is available to both assist with issue resolution and to track progress and dislodge jams in the system. There are some bright, young people recruited for authorizations in the Fort St. John office but they are inexperienced. They require leadership, support and encouragement.

In addition, the responses from the mail out to the Medium dugout owners will be coming in along with phone calls. The database must be checked regularly and a follow-up mail out to those who have not responded may be required as well as phone calls. Any dugouts that are suspected of being dams must be put on the list for assessment during the second assessment period.

A debrief should be held during this period of the rapid assessment process. What worked well, what not so well? How can improvements be made? Etc. Planning can build on this for the second assessment in the summer of 2018.

Second Assessment

This stage begins in April, 2018 and continues through to the end of September, 2018.

There may be Large or Very Large dugouts that were not assessed or could not be accessed for assessment in the summer of 2017. These should be scheduled for assessment in 2018. In addition, there may be applications for new dugouts that are dams under the legislation and will need classification and assessment. There will also be Medium dugouts that are identified from mail out or phone responses that are, or may be, dams. These too will need classification and assessment.

A second assessment process must be organized and implemented as soon as the snow is gone and the roads are in good condition to allow an efficient process to be put in place. There may be a need for a further helicopter exercise depending on the results and the number of larger dugouts that were not seen during the Rapid Assessment in 2017. The experience of 2017 should inform the planning for 2018. The technical staff and on occasion, administrative staff should get an opportunity to do assessment as a training exercise. Administrative staff who have participated in field operations are much more

engaged in their jobs and have a much better understanding of their important role in the water management process.

Normal Operations

This stage commences in September 2018 and continues into the future.

By this point normal water licensing procedures should be underway, with water licences being issued in response to applications. The high consequence dams will be identified and their owners will be taking the necessary steps to ensure safety. The owners of the other dugouts will know their responsibilities and the process of bringing them into compliance can continue.

7. FINAL COMMENTS

An old analogy for this kind of work is going out into an area to defuse some time bombs. You suspect they are out there, you don't know how many there are, and you want to find them and defuse them before they go off. And there are also bears in the area. You might see the bears. They are OK, they belong there. Don't disturb them but keep track of them. Focus on the time bombs.

This is a bit dramatic but it illustrates the problem. The first priority is to find the high consequence dams and make sure they are properly constructed and operated and maintained in an appropriate manner before any of them fail. There are other dams, they may pose some risk. Keep track of them and follow up to get them properly licensed and make sure their owners are aware of their responsibilities.

Many of the dugouts will require licensing. Hopefully a regulation can be passed that will take care of the inconsequential ones. There is a lot of work to do. Success will depend on strong senior level support, inspiring leadership, adequate resources and a lot of hard work from determined staff.

8. SUMMARY OF RECOMMENDATIONS

1. Create a senior-level Steering Committee.
2. Create a Dugout Database.
3. Determine land ownership.
4. Determine a Responsibility Center for each dugout.
5. Create an Administrative Team.
6. Recruit a water manager for the Fort St. John office.
7. Immediately recruit and train 2 new Dam Safety Officers for the Fort St. John office.
8. Share the “OG Dugout” Information with the Oil and Gas Commission.
9. Share the entire Dugout Database with the OGC.
10. Negotiate a protocol with the OGC for dugout responsibility and dugout assessment on gas leases.
11. Investigate and discuss joint assessments with OGC staff.
12. Create public messaging.
13. Seek a regulation to exempt small dugouts.
14. Communicate inside government about the Dugout activities.
15. Create a government dugout policy for seeking compliance and undertaking enforcement.
16. Seek to get Administrative Penalty Regulation completed and brought into force.
17. Directly contact owners of large dugouts that are unlicensed or for which there is no application in MLNRO or the OGC.
18. Create a field assessment plan.
19. Create an assessment team or teams.
20. Assess all 363 Large and 149 Very Large dugouts.
21. Assess medium dugouts that are easily accessible.
22. Create a plan to assess the remaining Medium dugouts as time and resources permit over the subsequent years.
23. Log all assessment findings into the Dugout Database.
24. Involve OGC and FLNRO Compliance and Enforcement Branches in assessment planning.
25. Ensure assessment staff are all familiar with the Compliance and Enforcement Policy.
26. Take enforcement action as necessary in accordance with the policy.
27. Prepare a quarterly report for the ADM.