Dugout Construction Guidelines

Ag Water Workshops – Coffee Talk
Rush Lake – Nov. 28th & Maple Creek – Nov. 29th

Photo: www1.agric.gov.ab.ca
The Water Security Agency was created in October of 2012 to support the Saskatchewan Plan for Growth and to deliver the 25 Year Water Security Plan for the Province.

By bringing together governments expertise and responsibilities for water, the WSA will ensure a comprehensive and integrated approach to water management.
The WSA is responsible for:

• Operation, management and safety of provincial dams and water conveyance works;
• Protection of drinking water and the regulation of municipal water and waste water treatment facilities;
• Protection of source water quality and aquatic habitat;
• Flow, lake level, and flood forecasting; and,
• Water supply planning, allocation of surface and ground water, and water conservation.
Dugout Planning

Watershed Runoff Potential

- A dugout needs to be located in an area of the watershed that will provide adequate runoff yield for the quantity of water required.
- Runoff yield is determined by the amount of precipitation (snow melt and rain) that occurs within the watershed, along with soil conditions, vegetation cover and topography.
- The smaller the runoff yield in an area, the larger contributing area is required to fill a dugout.
Acres Required to Yield One Million Imperial Gallons in 8 out of 10 years (80% availability)
Source: AAFC – Quality Farm Dugouts, 2002
# Dugout Planning

## Siting

### Figure 3 Dugout Types

<table>
<thead>
<tr>
<th>Recommended</th>
<th>Not Recommended</th>
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</table>
| ![Recommended Type 1](image1)  
The dugout is filled entirely with runoff water from surrounding lands | ![Not Recommended Type 1](image2)  
The dugout is constructed in a watercourse |
| ![Recommended Type 2](image3)  
The dugout is constructed near a watercourse or water source and inflow to the dugout can be controlled | ![Not Recommended Type 2](image4)  
The dugout collects ground water and surface water |

Source: AAFC – Quality Farm Dugouts, 2002
Dugout Planning

Shape and Size

• Most important factors to consider in sizing are runoff yield, evaporation losses and dimensions of the dugout.

• A deeper dugout is more efficient at storing water since it increases storage capacity without increasing surface area, thus reducing evaporation losses.

• Surface area of a dugout should be kept to a minimum by using 1.5:1 side and end slopes and digging as deep as possible.

• Most dugouts are now built 5-6m (16-20 feet) deep.

• Net evaporation losses in SW Saskatchewan are typically 0.6-0.9m (2-3 feet) per year.
Dugout Planning

Size

- Need to consider expected water use, as well as losses to evaporation and ice
- Calculate water demand based on use
  - Livestock type, # head, season of use
  - Crop spraying
  - Household, other
- Ideally, store at least two years worth of water
Dugout Planning

Size

Figure 10 Dugout Size vs. Available Water

Source: AAFC – Quality Farm Dugouts, 2002
Dugout Design

Slopes

• Typically in the past, Prairie dugouts were constructed with 1.5:1 side slopes and 4:1 end slopes.

• Currently the majority of new dugouts constructed have steep side and end slopes of 1.5:1.

• Steep slopes help reduce the growth of aquatic plants that contribute to organic nutrients in the water.

• Dugouts with steep slopes should be fenced off to exclude livestock and to protect against accidental drowning.
TYPICAL 1.5:1 SIDE AND END SLOPES

DUG WITH A TRACKHOE
Dugout Design

Erosion Control

• Spoil piles should be leveled and grassed to provide a filter that reduces incoming soil erosion and nutrients.

• The recommended grassed buffer around dugout sites is 10m (33 feet).

• Dugout side and end slopes should be protected with a combination of grass, rip-rap or geo-textile materials.

• Erosion control used on the slopes of a dugout help extend the life of the dugout and discourage muskrats from moving in.
Dugout Design

Livestock Exclusion

• Allowing livestock to directly access a dugout degrades water quality.

• It is recommended that all dugouts be fenced off and water supplied to livestock through remote systems.

• By fencing off and using a remote watering system on your dugout, you protect the dugout and its water quality as well as the livestock themselves.
Dugout Construction

Pre-Construction Testing

- In many areas, sand, silt and gravel layers occur close to the surface in Saskatchewan.

- Sand, silt and gravel layers can provide a path for water to seep out of the dugout. These lenses can also allow highly mineralized groundwater to seep into the dugout.

- Prior to starting construction, dig at least five or six holes around the perimeter of the proposed site to a depth of 1.2 -1.5m (4 to 5 feet) deeper than the proposed dugout bottom and no more than 30m (100 feet) apart to test for porous materials.
Dugout Construction
Sealing Methods and Materials

- **Clay Liner** – Haul in and spread the clay into problem areas and pack the clay into place with proper compaction equipment.

- **Bentonite** – Purchase from supplier, mix with soil and pack into place. Once bentonite is wetted, it expands and creates an impervious seal.

- **Plastic Liner** – Expensive and particular to install. For the liner to last, it must be thick or covered with a sand layer. Liner installation requires a low slope for proper placement.
Resources

Quality FARM DUGOUTS

AAFC, 2002
Domestic Purpose Exemptions

• Any owner or occupant of land may use up to 5000 cubic meters (1.1 million gallons) of water per year drawn from a dugout on the land without a License or Approval, provided the storage capacity of the dugout does not exceed 5000 cubic meters.

• A dugout would have to be 200 ft long x 85 ft wide x 18 ft deep to be over 5000 cubic meters. (1.5:1 side and end slopes)
Domestic Purpose where a License and Approval is Required

- Use that exceed 5000 cubic meters per year.
- Dams, dykes, ditches, etc. for the diversion or impoundment of water.
- Dugout with storage over 5000 cubic meters.
- Dugout with storage of less than 5000 cubic meters but has works for diversion or impoundment of water.
- Point of diversion or point of water use is on land not owned or occupied by the user.
Questions?

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