Proposed Millsite Reservoir Annual Dredging Sequence

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Figure 1 provides a basis for this discussion and shows both the median and average daily inflows to Millsite Reservoir for the period of record for the USGS stream gage upstream. Since this is the first time that sediment removal will have been done, experience will be needed to better define when the designated events actually occur. A log will be kept each year of the dates indicated in the boxes; this will help to better plan operations in the future. There are six key times shown on the Figure; each one will be briefly described below.

1. See Figure 1, Box 1. The reservoir begins to fill with spring runoff water from Ferron Creek.

2. See Figure 1, Box 2. Begin dredging while the reservoir is filling. Exactly when this occurs will be a judgment call based on the reservoir water level left from last year and data describing the snowpack for this year. Put the dredge discharge into sediment storage area 5 designated in Figure 2. The other storage areas may be used in the future after appropriate permitting has been granted.

3. See Figure 1, Box 3. At some point the reservoir fills and water starts spilling over the spillway. Move the dredge discharge to the spillway so clear water outflows carry the sediment downstream of the dam.

4. See Figure 1, Box 5 and the blue line. The water flow rate, cubic feet per second (CFS), leaving the reservoir via the spillway is approximately equal to the water flow rate entering the reservoir. There is a slight difference as the water level in the reservoir is rising, stops rising and is falling.

5. Continue dredging at a discharge rate that does not exceed allowable limits of Nephlemetric Turbidity Units (NTU) and Dissolved Oxygen (DO) specified by the Utah Department of Environmental Quality (DEQ) and Utah Division of Wildlife (DWR). These allowable limits are not the standards quoted in existing documents but rather will be for a creek such as Ferron Creek with its downstream habitat requirements for native Utah fishes.

6. A monitoring station will be established in the stream below the reservoir. Monitored data would be transmitted to a satellite and then posted to the Internet. With a portable device, the dredge operator can see the levels in the stream below the dam and increase or decrease discharge as needed to maximize sediment removal and still stay below defined limits. This establishes a, “real time” control of dredging operations. This maximizes the amount of sediment removed from the reservoir while at the same time protecting the stream ecosystem below the dam.

7. See Figure 1, Box 6. Continue the dredge discharge out the spillway until water no longer spills. The time the spill stops will be determined by the inflow rate and the rate at which water is removed from the reservoir for irrigation and other uses. Stopping dredging at this time keeps the amount of water removed from the reservoir to a minimum.

8. If desired, move the dredge discharge pipe to storage area 5 designated in Figure 2. Continue dredging as long as desired. Dredging after the spillway stops spilling removes small amounts of stored water from the reservoir.

9. Stop dredging for the season.

10. In those years when the spillway does not spill, dredging can remove sediment from the reservoir and put it into one of the approved storage areas. However, this will remove small amounts of stored water from the reservoir during a low water year when there is less water coming into the reservoir. Since no sediment is put into the stream below the dam, this can be done at any time during the year without DEQ or DWR approval. Dredging under these circumstances could be done at the end of the irrigation season when it can be seen if sufficient water is available in the reservoir. Of course, water removed at the end of the season cannot be carried over to next year. Also, dredging would be more costly since there is a greater hydraulic head to remove sediment with a low water level in the reservoir.

11. Sediment storage areas one, two and three are located below the dam. It appears some of the water draining from them will flow to Ferron Creek below the dam. It may be advantageous to put a standpipe in each of these areas to direct the flow to the creek. This would add to flows in the stream while water seeps out of the discharged sediment and less water will be lost. Since they are at an elevation higher than the reservoir, water discharged to sediment storage areas four and five will likely drain back into the reservoir. Area four is immediately adjacent to the reservoir and no standpipe appears necessary. For area five, a standpipe to direct the water back to the reservoir may be advantageous. Thus, water loss due to dredging can be kept to a minimum.

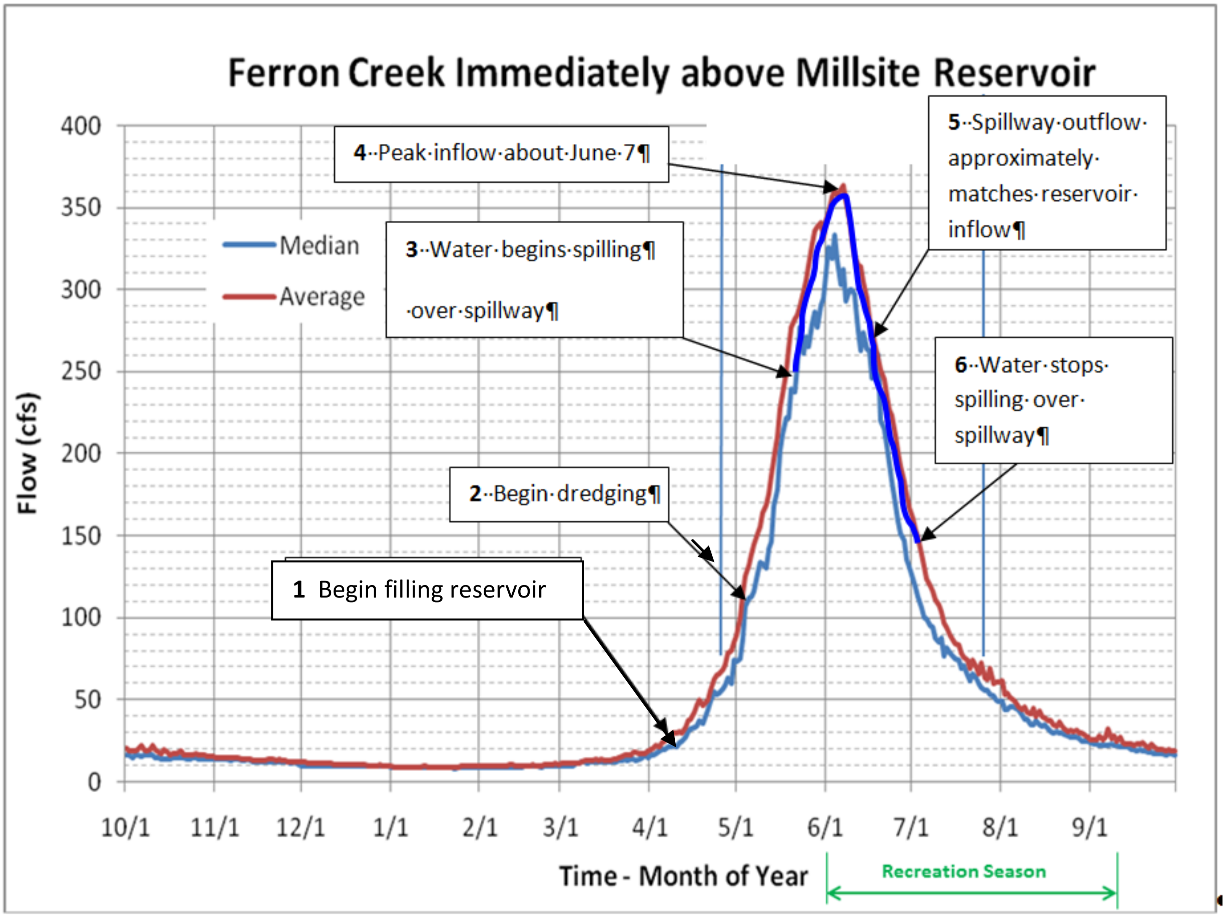

Figure 1. **Ferron Creek Hydrograph or Inflow to Millsite Reservoir based on USGS gage records.**

Figure 2. **Sediment Storage Sites. As of April 2014, Site 5 has been approved.**

<u>Other Relevant Data</u>

The sediment deposition rate is about 73 acre-feet per year. At that rate, it is estimated there is sufficient volume available in the five sediment storage sites to accommodate about 200 years' worth of sediment (personal communication, Michael Suflita). See Figure 2.

See Figure 3 for a description of the dredge (www.imsdredge.com). According to the dredge specification sheet, the pump discharge rate is about 3,500 gallons per minute or 7.8 CFS. From Figure 1 it can be estimated that the spillway discharge will be on the order of 300 CFS. Using these numbers, the pump discharge is about 2.5 percent of the spillway discharge. It appears sediment levels will be quite low and therefore unlikely to impair the ecosystem downstream of the dam. If production were sustained at the published maximum of 200 yd^3/hr, it would take about 600 operating hours to remove the annual incoming load each year – about 3.5 weeks of continuous operation. Since production cannot be sustained at the maximum rate, more time would be required, but a significant amount of sediment can be moved downstream during the spilling season.

The book, *Fishes of Utah, A Natural History* by William F. Sigler and John W. Sigler, University of Utah Press, 1996, could be used to determine allowable limits of NTU and DO downstream of the dam.

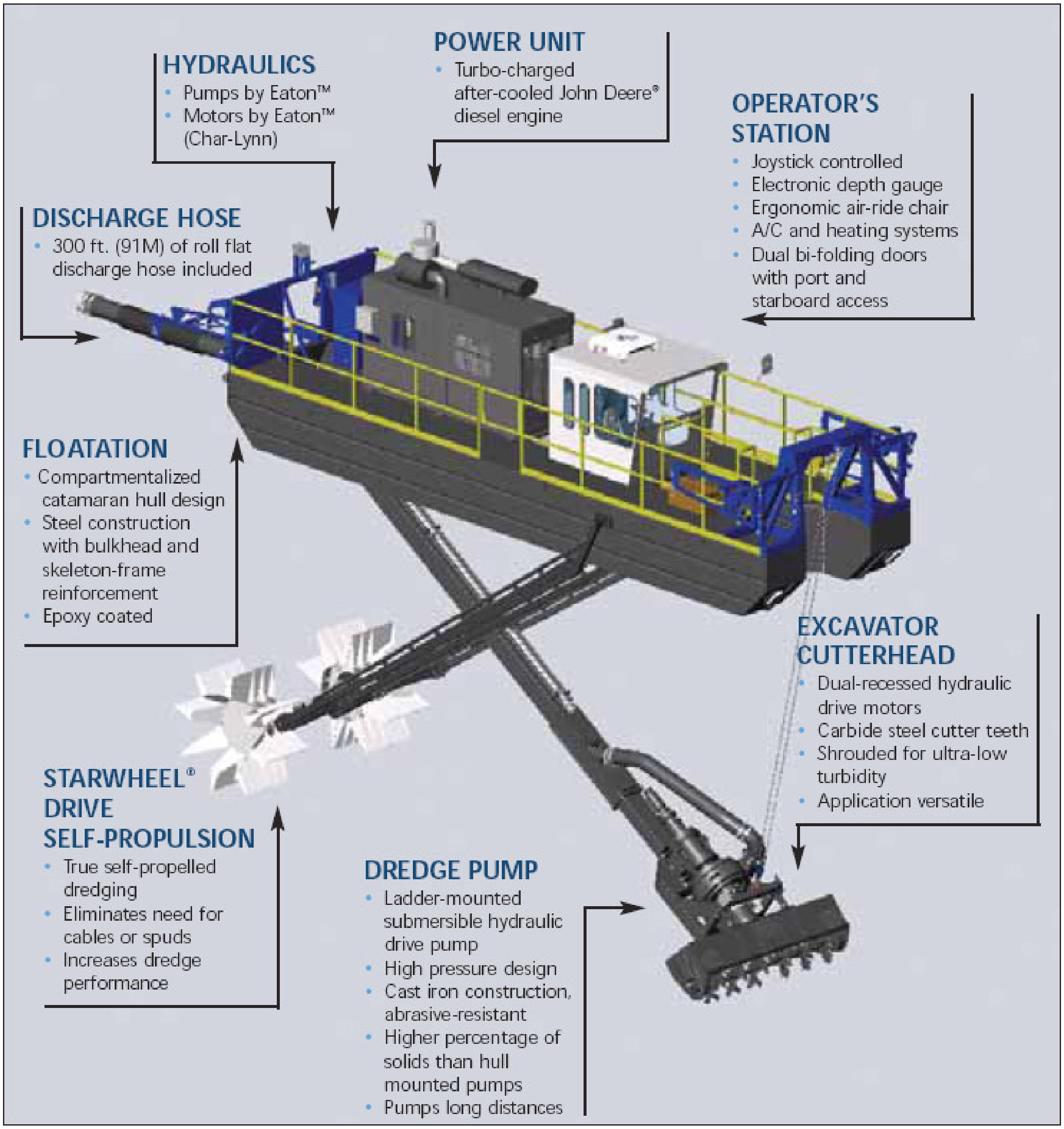

Figure 3. **Dredge Used to Remove Sediment from Millsite Reservoir. IMS Model 5012 LP. Website www.imsdredge.com**