

**Proposed Shooting Star Resort and Casino
Groundwater Summary
Star Lake, Minnesota**

July 26, 2017

1. EXISTING CONDITIONS

a. Local geology related to groundwater withdrawal (conceptual)

At the proposed project site, there is 69' of native clay material above a 35' sand and gravel layer which is underlain by a clay layer.

b. Number and type of nearby potable and non-potable (if any) wells

There are six domestic water wells within one mile of the project site listed in the Minnesota Geological Survey/Minnesota Department of Health (MDH) County Well Index database. The nearest is 1000' away.

c. Relative depths, producing aquifers and yields of local wells

According to the well logs, area wells produce their water from sands and gravels between 70 and 106 feet below the ground surface. The six area well logs show significant thicknesses (46 to 80 feet) of clay between the ground surface and the top of the water-bearing sands and gravels.

d. Water quality of local aquifers/need for treatment

The quality of the water from a test well was analyzed and there were levels of iron, manganese, and hardness that require treatment. The treatment system is intended to remove iron and manganese through filtration and remove hardness through reverse osmosis.

e. Likely future demand on aquifer will increase incrementally through normal infill development

There may be a future demand on the aquifer through normal infill development, although according to the test pumping data the aquifer is robust and capable of handling increased demands.

f. Relationship between Star Lake and aquifer water (conceptual)

Conceptually the sand and gravel layer contributing water to our proposed well is approximately 40 feet below the water elevation of Star Lake. Star Lake appears to be discharging water south and west toward our proposed well location based on neighboring lake elevations.

g. Known or suspected existing groundwater contamination

We are not aware of and have no reason to suspect existing groundwater contamination. We don't anticipate a source of contaminants and the surface permeability has been shown to be low.

2. PROPOSED ACTIONS

a. Construction of potable well for site use

i. Proposed depth

The depth of the well is 104'.

Proposed producing aquifer

The well will pump from a 35' sand and gravel layer located between 69 and 104 feet below the surface.

ii. Estimated volumes of water needed

It is estimated that the well will produce a maximum of 35 million gallons per year. The anticipated water demand for the project is 13.8 million gallons per year.

iii. Test well and pumping test

1. Test well location and specifications

The test well is located approx. 2,000 ft. north of the Star Lake site. The test well was cased in 6" PVC well casing with a 20' stainless steel well screen. In addition to the test well, a 2" PVC observation well was installed to determine aquifer performance.

2. Water quality testing/need for treatment

The test well for Star Lake was tested and analyzed for the majority of EPA's primary and secondary drinking water standards. The water quality of the aquifer was tested and there were levels of iron, manganese, and hardness that require treatment. The treatment system is intended to remove iron and manganese through filtration and remove hardness through reverse osmosis.

3. Pumping test results

a. Pumping rates and duration

The test well was pumped at a rate of 240 gpm (the maximum withdrawal rate anticipated for the development at full buildout). The pumping test and drawdown measurements were taken for a period of 24 hours.

b. Direct measurements of water levels during pumping test

During the pumping test, water level measurements were recorded from the test well and the observation well. Water level data was recorded every 5 minutes for the first 20 minutes, then hourly for 24 hours. The measured drawdown in the test well after 24 hours being pumped at 240 gpm was 11' 8.5", and the corresponding water level drop in the nearby observation well was only 6.5".

c. Implications for likelihood of interference with local domestic wells

There are six domestic wells within one mile of the project site listed in the Minnesota Department of Health County Well Index. The closest well to the test well is over 1,000' away. During the well test pumping there was a 2" observation well installed that was 15' away from the test well. The water level drop in the observation well was only 1.5' which indicates a robust healthy aquifer which is anticipated to have minimal impacts to surrounding wells.

d. Implications for future groundwater contamination from ground surface activities

It is well understood that the aquifer materials are buried. Recharge to these sands and gravels vertically are confined to areas where the till layer is thin or not in existence. At our proposed location, the till layer is approximately 69 feet thick limiting vertical connection from the surface to the aquifer materials. It is expected wellhead protection measures will be implemented similar to other water systems of similar size and usage.

3. REGULATORY CONTROLS

a. Minnesota Department of Health

i. Regulation of well construction through Water Well Code

The MDH has determined that the water supply well falls under a non-community water supply system and has deferred any entitlements to the EPA. The EPA regulates the construction of the well.

ii. Permitting of potable well

The MDH has determined that the water supply well falls under a non-community water supply system and has deferred any entitlements to the EPA. The test pumping on the wells has been sent to the DNR for water appropriation permitting.

iii. Initial water quality testing required

The initial water quality that was tested will be sent to the EPA. They will require periodic testing to be done once the system is producing water.

iv. Periodic water quality testing required

There will be periodic water quality testing that will be sent to the EPA.

b. Minnesota Department of Natural Resources

i. Groundwater appropriation permitting

The test pumping on the wells has been sent to the DNR for water appropriation permitting. They will analyze the aquifer and determine water appropriation rights for the well.

ii. Investigate well interference complaints

The MnDNR will investigate any well interference complaints in the area.

4. MITIGATION MEASURES

a. If well interference develops:

i. Reduce groundwater potable use/supplement non-potable use with use of graywater

Reducing groundwater potable use and supplementing it with graywater may be possible but additional treatment may be required.

ii. Reduce groundwater potable use/ supplement potable use with treated lake water.

Reducing groundwater and supplementing it with treated lake water is possible but would require additional treatment.