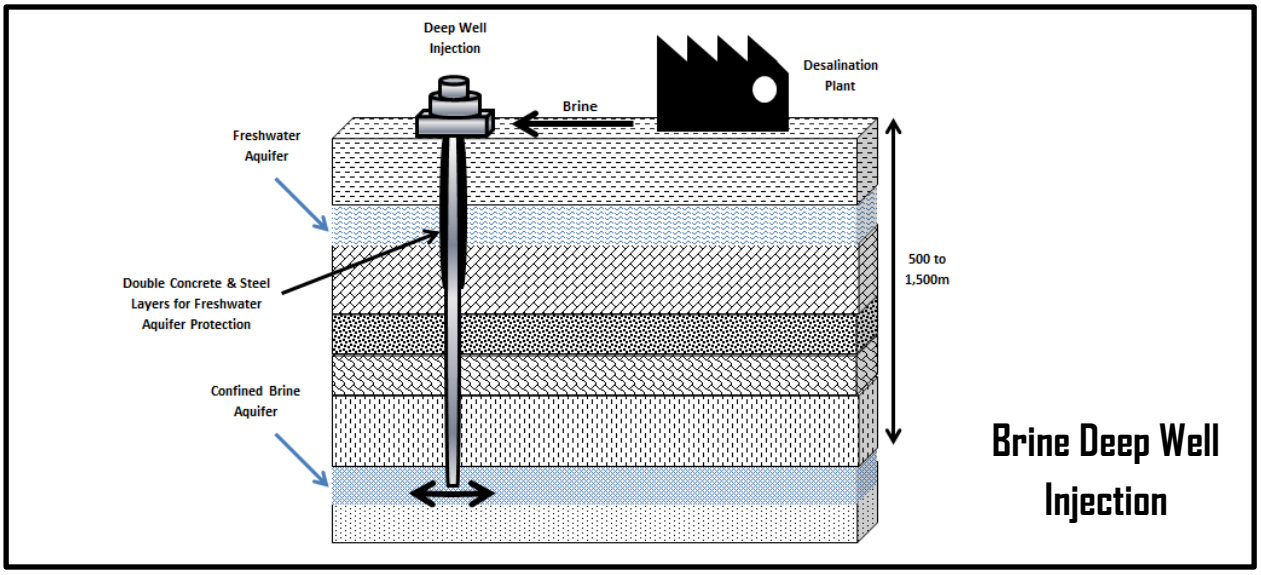

Brine is injected into porous subsurface rock formations

Advantages (+)	Disadvantages (-)
Suitable for inland plants	Only if confined saline aquifer available
Moderate Costs	Potential groundwater contamination
Low Energy Consumption	/

1. Potential Environmental Impacts

2. Criteria and Methods for Feasibility Assessment

3. Injection Well Costs

In this the desalination brine from every plant size is injected into an adequate deep underground aquifer (500 to 1500 m) that is separated from freshwater or BW aquifers above.

Brine disposal wells typically consist of three or more concentric layers of pipe: surface casing, long string casing, and injection tubing. A deep injection well consists of a wellhead (equipped with pump, if needed) and a lined well shaft protected by multiple layers of casing and grouting.

Shallow exfiltration beach well systems could also be used. Beach well disposal discharge the brine into a relatively shallow unconfined coastal aquifer that ultimately conveys the brine into the open ocean through the bottom sediments. Discharge beach wells are mainly used for small to medium size SW desalination plants.

1. Potential Environmental Impacts

From the 20 year experience of brine disposal with the deep well injection method in the United States, it has proven to be reliable with a low probability of negative effects for the environment. But during the planning of its implementation, we should pay attention to the

following factors that might allow for upward migration of the brine and possible contamination of shallow aquifers,

1) corrosion or excessive feed pressure could result in a failure of the injection well casing and leaking of the brine through the well bore
2) vertical propagation of the brine outside of the well casing to the shallow aquifer
3) if the overlaying confining bed has high permeability, solution channels, joints, faults, or fractures we'll have vertical brine migration
4) nearby wells, which are inappropriately cemented or plugged or have an inadequate casing could provide a pathway for the injected brine

During the well operation there's a continuous monitoring of brine flow and the wellhead pressure. Increasing pressure during steady operation could indicate possible clogging, while a sudden decrease in pressure is indicative of leaks within the casing, grout, or seal. We must also ensure with monthly testings that the well is not leaking into underground soils or water sources. Plugging, contamination, and wide variations in brine flow rates and pressures should be avoided. Plugging can be due to bacterial growth, suspended solids precipitation or entrained air.

2. Criteria and Methods for Feasibility Assessment

In order to apply a deep well injection systems for brine disposal we must have confined aquifers of large storage capacity with good soil transmissivity. We must avoid areas of high seismic activity or sites near geologic faults that can result in a direct hydraulic connection between the storage and a freshwater aquifer.

Usually legislation permits will need the storage aquifer's transmissivity and TDS, the presence of a structurally isolating and confining layer between the receiving aquifer, and the presence of overlying with < 10,000 mg/L TDS.

3. Injection Well Costs

Deep injection well costs are mainly influenced by the well depth and the diameter of the well tubing and the casing rings. The following table gives a rough approach of the construction costs for deep injection wells as a function of brine discharge flow (m^3/d) and well depth (m).

Table 1, Construction Costs of Brine Disposal Deep Injection Wells

Well Diameter (m)	Typical Discharge Capacity (m3/d)	Construction Costs ($) as a function of Brine Flow Rate, Q (m3/d) and Well Depth, H (m)
100	1,000-2,000	165 x Q + 310 x H + 100,000
200	4,500-6,500	180 x Q + 1,250 x H + 160,000
300	10,000-15,000	165 x Q + 2,000 x H + 290,000
400	15,000-30,000	160 x Q + 2,800 x H + 330,000
500	30,000-50,000	150 x Q + 4,500 x H + 370,000