Section 3 – Local Hydrogeology

3.1. Summary of Hydrogeology, Hydrology, and Water Quality

The hydrogeologic framework of northern Pinellas County can be summarized as a surficial aquifer system (SAS), an intermediate confining unit, and the underlying Floridan aquifer system. Each aquifer system contains one or more permeable zones separated by less permeable units. It is the more permeable zones that are best suited for water production from wells.

A generalized hydrogeologic section for the Tarpon Springs area is shown in Figure 3-1. This hydrogeologic section shows associated formations, permeable zones, approximate extent of the Underground Source of Drinking Water (USDW) and estimated water quality from available data. Available data includes a generalized hydrogeologic section of the Dunedin area (Knochenmus and Swenson, 1996), data from a test well in Northwest Pinellas County, site specific data collected from a hydrogeologic investigation for the City (CH2M HILL, 1978), and well completion reports for the City's test production wells adjacent to Disston Avenue.

Surficial Aquifer System (SAS)

The uppermost water-bearing unit is the SAS. This unit varies in thickness ranging from 10 feet to 50 feet in the area. Because of the limited thickness of this layer, the variable water levels and aquifer characteristics, potential yields from this upper layer are not substantial enough to be considered as a source of municipal water supply in this area.

Intermediate Confining Unit

The intermediate confining unit is composed of clay-like materials that serve to retard the vertical movement of water between the SAS and the Floridan aquifer system. Based on pumping test data collected from the City's Disston Avenue wells (City of Tarpon Springs, 2003), the intermediate confining unit serves to limit drawdown of the surficial aquifer as a result of withdrawals from the underlying unit (Zone A).

Floridan Aquifer System

The Floridan aquifer consists of a sequence of limestones, dolomites, and evaporates. The upper Floridan aquifer is divided into 4 primary permeable zones (Hickey, 1982): Zones A, B, C, and D. Zone A, the uppermost permeable zone in the Floridan aquifer, can be further subdivided into Upper Zone A and Lower Zone A.

Upper Zone A contains fresh water except in coastal areas. This zone is utilized by the City for 3 existing production wells and 4 existing test wells not yet in production. Water quality data from the Disston Avenue wells completed in Upper Zone A indicates chloride concentrations of approximately 40 – 80 mg/L from wells producing approximately 200 gallons per minute (gpm). It is understood from local monitoring wells in the coastal area that groundwater in this zone can become brackish very quickly towards the coast. Freshwater production in the Disston Avenue area will require careful development and operation to maintain production and limit increases in salinity. In addition, impacts to surface water bodies and wetlands in the vicinity of production wells would need to be considered as part of well permitting and operation.

Lower Zone A is contained within the lower portion of the Tampa Member and the upper portion of the Suwannee Limestone. When combined with Upper Zone A, this zone is potentially productive. The water quality in Lower Zone A can degrade rapidly with depth as

evidenced from test drilling in the Pinellas Park area (CDM, 2001). In fact, data from the Pinellas Park testing shows the limit of the underground source of drinking water – defined as 10,000 mg/L total dissolved solids – is within Lower Zone A.

Zone A has the most potential for raw water supply for the City of Tarpon Springs. Additional wells completed into Upper Zone A could yield drinking water without the need for desalting and very little additional treatment aside from disinfection. For greater capacity, brackish wells open to both Upper Zone A and Lower Zone A could be developed. The location, completion depth, and withdrawal rate from these wells would need to be optimized to prevent upconing of highly brackish water. Cycling of wells or having enough well capacity to reduce individual pumping rates during the dry season would assist in overcoming this.

Zone B is comprised of the lower portion of the Suwannee Limestone and the upper Ocala Group. Depending on the extent of the USDW, this zone can be very brackish (in excess of 10,000 mg/L chlorides). Data from the City of Dunedin indicate this zone is less productive than Zone A. Water produced from this zone would require moderate to substantial desalting, though not to the extent required for seawater sources.

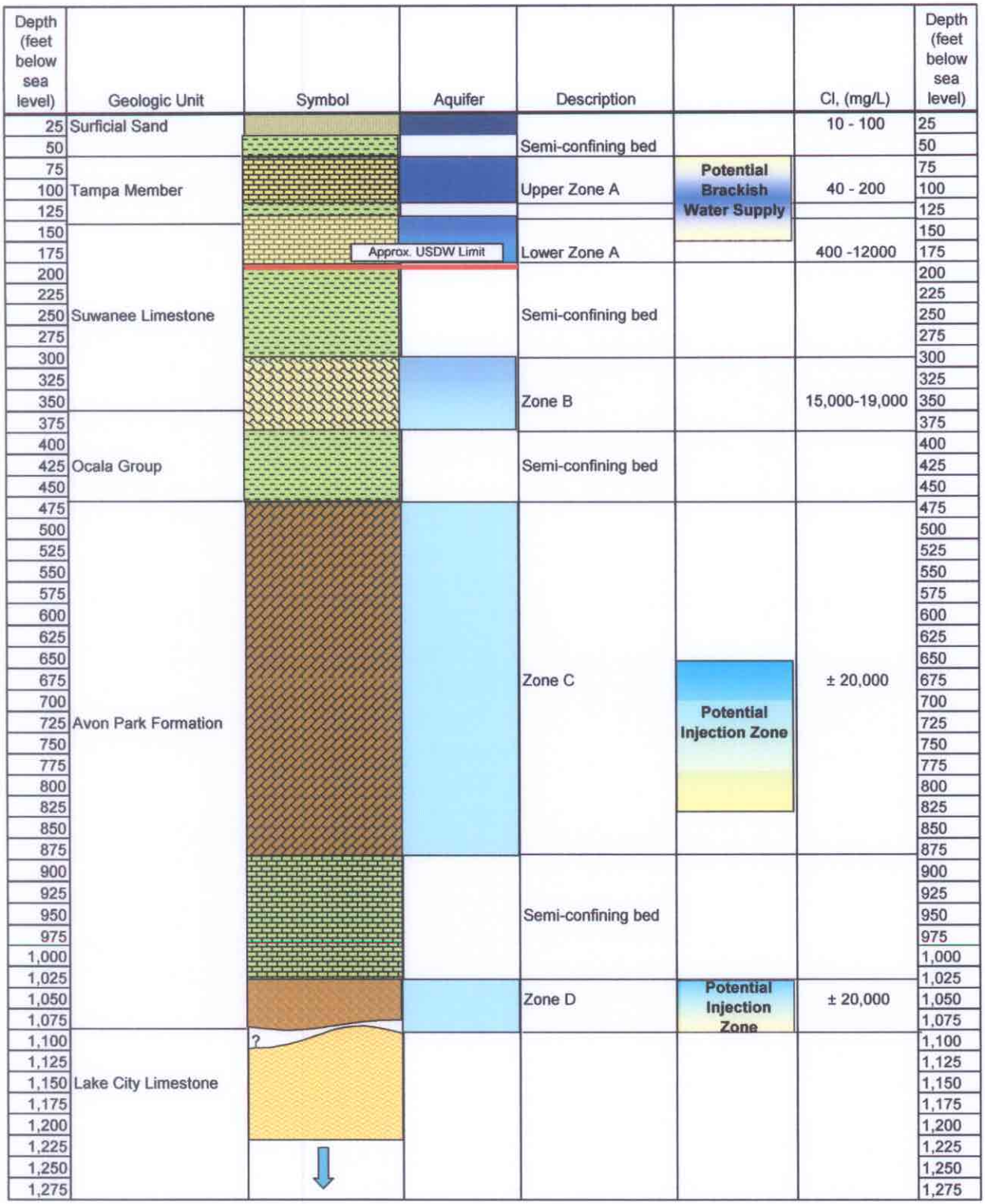
Zone C is contained within the Avon Park Formation. In the coastal portions of Pinellas County, this zone is saline and has the similar characteristics to seawater. Zone C has been and continues to be used within Pinellas County for underground injection of wastewater. This zone is very transmissive and can accommodate injection of over 5 mgd per injection well. An operational issue with the injection wells currently operated by the City of St. Petersburg is the upward migration of the relatively fresh wastewater. It is believed the primary driving force for this upward migration is the relative buoyancy difference between the injected water and the native groundwater within Zone C. The fresher wastewater with its potential to "float" upward, places additional pressure on overlying confinement.

A concept being developed by Tampa Bay Water for the Mid-Pinellas Brackish Water Desalination Project (MPBWDP) is the disposal of brackish RO process concentrate into Zone C. In its application to the Florida Department of Environmental Protection (FDEP), Tampa Bay Water indicates that the disposal of the denser RO concentrate instead of fresher wastewater will significantly reduce the potential for upward migration.

A challenge in the Tarpon Springs area for an injection well would be demonstrating adequate confinement above the injection zone. Data indicate that confinement thins in northern Pinellas County between Zone C and the overlying extent of the USDW. Per the requirements of FAC 62-528; "no injection shall be allowed that allows the movement of fluids into an underground source of drinking water (USDW) if such movement may cause the violation of any primary drinking water standard or may otherwise adversely affect the health of persons". If deep well injection is pursued as a disposal option, strong consideration should be given to exploring an injection zone that would offer additional layer(s) of confinement.

Zone D is located at the base of the Avon Park Formation. Little is known about this formation except that is consists of dolomite and limestone. Water quality is expected to be similar to seawater. Minimal information is available regarding the productivity or injection capacity of this zone. If injection is considered as a means of RO concentrate disposal for the City of

Tarpon Springs, Zone D may be considered for exploration with a test well. The additional confining bed between Zone C and Zone D would provide additional protection of the overlying USDW from injection activities.



Sources: Knochenmus and Swensen, USGS (1996); CDM (2002), modified from Hickey (1982)

FIGURE 3-1
Approximate Hydrogeologic Section in the Tarpon Springs Area

3.2. Pumping Test Conducted at City's Disston Avenue Wellfield

The City constructed 4 production wells (5A, 5B, 5C, and 5D) and an associated monitoring well system in the late 1980's as a means of increasing its independent water supply. The wells are completed into Upper Zone A. The location and configuration of the wellfield was based on recommendations from a previous investigation for additional water supply completed by engineering consultant CH2M HILL (CH2M HILL, 1978). The wells are located within a Progress Energy high voltage power line easement adjacent to Disston Avenue, immediately north of Klosterman Road, extending north to Curlew Place.

The wells have an existing water use permit (Appendix A) but remain inactive awaiting final treatment and storage facilities that were never pursued during the 1990's. Well 5A is not currently permitted as a production well. An effort is planned to increase this well's capacity.

Results of the Pumping Test in February, 2003, and Potential Freshwater Wells

The purpose of this recent pumping test completed by City staff was to confirm well capacity, water quality, and assess any changes in aquifer water levels as a result of withdrawal. Wells 5B, 5C, and 5D were pumped simultaneously for approximately 96 hours. Results of pumping and water quality testing indicate that each of the wells is capable of providing an estimated 200 gpm of fresh water (40 mg/L to 80 mg/L chlorides) with minimal impact to the surrounding aquifer system at that pumping rate.

Primary and secondary water quality parameters were collected and analyzed by an accredited laboratory for production wells 5B, 5C, and 5D at the end of the pumping period. Results indicate the raw water meets all primary and secondary standards with the exception of an iron exceedence in well 5C. As an operational consideration, water quality (salinity) would require close monitoring using best management practices during the dry season and well pumping rates might need to be reduced during those periods to preserve water quality at each well. This precaution is based on previous experience with the City's current production wells completed in the same aquifer zone.

Pumping test results indicate that well 5C would be more costly to develop and operate than wells 5B and 5D due to the iron content of the water of 5C. Development of wells 5B, 5D, and possibly increasing the capacity of 5A should be priority. The withdrawal limits of 5C could be reassigned to 5A with the approval of SWFWMD within the current permit.

Preliminary cost analysis and experience with the existing wells indicate that up to 2 additional wells could be developed within the same power line easement along Disston, to the north of well 5D. This source of additional freshwater supply should remain as future option.

A detailed description of the test and results of analysis is presented in a summary report provided in Appendix B.

A summary of the construction details of the production wells and the monitoring wells is provided in Table 3-1.

Table 3-1. Summary of Production Well and Monitoring Well Data

Well ID	Ground or pad elevation (ft. NGVD)	TOC (MP) elev. (ft. NGVD)	stick-up height (ft)	Total Depth (ft)	Total Depth (ft. NGVD)	Static WL (ft. NGVD)	Original driller's reports
Well 5A	34.16	37.70	3.54	*135.00*	*-100.84*	4.45	135 cased to 68 ft
Well 5B	29.10	32.68	3.58	*101.00*	*-71.90*	4.46	cased to 61
Well 5C	31.54	34.62	3.08	130.00	-98.46	4.27	cased to 74 ft
Well 5D	33.74	37.45	3.71	130.00	-96.26	4.18	126 cased to 83; lost circ. @ 126'
MW-50	22.94	25.44	2.50	30.82	-7.88	4.04	30
MW-51	28.35	30.85	2.50	107.60	-79.25	4.41	188 cased to 170
MW-52	28.39	30.14	1.75	96.10	-67.71	4.37	140 cased to 130
MW-53	28.92	31.32	2.40	36.60	-7.68	4.42	36 cased to 26
MW-54	21.19	24.97	3.78	175.58	-154.39	4.27	170 cased to 160
MW-55	33.37	35.32	1.95	40.30	-6.93	4.57	38 cased to 28
MW-56	29.04	30.80	1.76	30.75	-1.71	4.47	30 cased to 20
MW-57	41.52	43.35	1.78	133.00	-91.43	4.45	140 cased to 56
MW-58	40.45	43.14	3.90	86.00	-46.76	4.44	
temp staff gage		2.85				4.40	

Production well

surficial aquifer monitor well

3.3. Hydrogeological Compilation by Boyle Engineering, September 2003

In September 2003, Boyle Engineering Corporation (Boyle) completed a preliminary review of the local hydrogeology of Tarpon Springs to determine the potential for brackish water resources. The Technical Memorandum presenting this information is included in Appendix C.

Findings from the review completed by Boyle include:

- Moderately permeable sediments are probably present within the upper Floridan aquifer throughout much of the Tarpon Springs area that could potentially be developed for water supply/
- Brackish groundwater resources in the Tarpon Springs area are limited to the upper 150 feet or less of the Floridan aquifer system.
- Hydrogeologic conditions generally favor development of brackish water supply in the eastern portion of the City (more inland).
- Brackish water resources extend to a somewhat deeper depth north of the Anclote River compared with the southern portion of the City, thus conditions for wellfield development may be more favorable in that area.
- A field testing plan is recommended as the next phase of investigation and planning for this facility. This testing plan would include the construction of several test wells that would provide valuable information on actual hydrologic conditions, ground water quality and well capacity.