Before you Begin
This document presents a method for assessing buoyancy control needs for Infiltrator Water Technologies (Infiltrator) IM-Series tanks. Tank buoyancy control measures must be implemented according to state and/or local regulations, which may supersede these guidelines. If unsure of the requirements for a particular site, contact the local health department or permitting authority.

If tank buoyancy control measures are implemented, refer to Infiltrator IM-Series Tank Installation Instructions and Riser Connection Guidance documents, as applicable, for completing the installation.

How to Use this Document
1. Using Step 1, Table 1 and Figures 1 and 2, verify that the water level outside the tank is below the outlet pipe saddle height and determine if buoyancy control is required.
2. Use the appropriate row in Step 2, Table 2 to determine the minimum buoyancy control methods for the site conditions.
3. Once the preferred buoyancy control method is selected, follow the implementation procedures provided in Step 3.

Step 1 – Determine Need for Buoyancy Control
Required information: (1) maximum height of water outside the tank and above the tank bottom; and (2) the depth of soil cover above the tank top. Tank buoyancy control may be required if:
• the water level outside the tank has the potential to rise 30 inches (750 mm) or more above the bottom of the tank; and
• less than 12 inches (300 mm) of soil cover is to be placed as backfill over the tank top.

NO BUOYANCY CONTROL IS REQUIRED IF THERE IS AT LEAST 12 INCHES (300 MM) OF SOIL COVER ABOVE THE TANK TOP.

Allowable Subsurface Water Elevation
Groundwater elevation, groundwater table, and water table are terms for the subsurface condition where water is held in the subsurface soil pores or rock. The seasonal high groundwater elevation represents the sustained highest point the water table has the potential to reach at any time of the year. That point is not necessarily the level at which groundwater may be observed seeping from the soil at the time of tank installation. In general, a qualified soil evaluator or engineer can estimate the seasonal high groundwater elevation from careful examination of the soil profile.

Under certain conditions, a perched water table may be present in the subsurface. A perched water table occurs where there is an impermeable or low-permeability soil that causes water to be present in the soil pores above the main water table. A perched water table elevation may exceed the seasonal high elevation of the main water table. The vertical position of the tank must account for both the seasonal high groundwater table and any existing or future perched water table condition. Verify that the subsurface water elevation will not exceed the height of the outlet pipe saddle of the tank, as shown in Figure 1 and described in Table 1.

Table 1 Instructions
1. In the left-hand column of Table 1, locate the row corresponding to the height of the water elevation outside the tank and above the tank bottom (Parameter I) for the site conditions. See Figure 2.
2. Follow that row to the right until reaching the column corresponding to the depth of soil cover proposed above the tank top (Parameter II). See Figure 2.
3. If the tank model is listed in that cell, then buoyancy control is required (proceed to Step 2). If the tank model is not listed in that cell, then no buoyancy control is required.
4. IM-Series tanks shall not be installed where the water level outside the tank exceeds the height of the outlet pipe saddle.

Table 1: Infiltrator Tank Models¹ and Conditions Requiring Buoyancy Control

<table>
<thead>
<tr>
<th>Parameter I: Water height² above tank bottom</th>
<th>Parameter II: Soil cover depth above tank top³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1 Above outlet pipe saddle⁴ (greater than 43&quot; [1,075 mm])</td>
<td>Do not install</td>
</tr>
<tr>
<td>2 36&quot; (900 mm) to 43&quot; (1,075 mm) (to outlet pipe saddle)</td>
<td>All models</td>
</tr>
<tr>
<td>3 30&quot; (750 mm) to 36&quot; (900 mm)</td>
<td>IM-1530</td>
</tr>
<tr>
<td>4 Less than 30&quot; (750 mm)</td>
<td>Not Required</td>
</tr>
</tbody>
</table>

NOTES:
1. Infiltrator tank models include: IM-540, IM-1060, and IM-1530.
2. Water height corresponds to seasonal high groundwater elevation or perched water elevation measured from bottom-of-tank elevation.
3. Minimum 6 inches (150 mm) soil cover backfill is required.
4. IM-Series tanks shall not be installed where the water level outside the tank exceeds the height of the outlet pipe saddle.

Figure 1: Assessing Water Elevation

Figure 2: Buoyancy Control Parameters for Table 1

Contact Infiltrator Water Technologies’ Technical Services Department for assistance at 1-800-221-4436.
Step 2 – Determine Buoyancy Control Method

Step 2 is used if the Step 1 analysis shows that buoyancy control is required for the tank model and installation conditions. The site-specific maximum height of water outside of the tank and above the tank bottom and the depth of soil cover above the tank top must be known to complete Step 2.

Table 2 Instructions

For the appropriate tank model, select the desired buoyancy control method under each method description column. Refer to the Compatible Devices and Products and Step 3 – Implementation sections of this document for additional information on the buoyancy control methods shown in Table 2.

Table 2: Buoyancy Control Method Selection

<table>
<thead>
<tr>
<th>Tank Model</th>
<th>Parameter I: Water height above tank bottom</th>
<th>Parameter II: Soil cover depth above tank top</th>
<th>Minimum supplemental downward force required&quot; (total, both tank sides)</th>
<th>Buoyancy Control Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concrete-filled half pipe (min. length/ side)</td>
<td>Concrete parking bumper (min. length/ side)</td>
</tr>
<tr>
<td>IM-540</td>
<td>36 in (900 mm) to outlet pipe saddle¹</td>
<td>6 in (150 mm) to 12 in (300 mm)</td>
<td>2,200 lbs (1,000 kg)</td>
<td>3.8 ft (1.2 m)</td>
</tr>
<tr>
<td>IM-1060</td>
<td>36 in (900 mm) to outlet pipe saddle¹</td>
<td>6 in (150 mm) to 12 in (300 mm)</td>
<td>2,700 lbs (1,225 kg)</td>
<td>4.2 ft (1.3 m)</td>
</tr>
<tr>
<td>IM-1530</td>
<td>30 in (750 mm) to outlet pipe saddle¹</td>
<td>6 in (150 mm) to 12 in (300 mm)</td>
<td>4,300 lbs (1,955 kg)</td>
<td>6.3 ft (2.0 m)</td>
</tr>
</tbody>
</table>

NOTES:
1. See Supplemental Force discussion below.
2. IM-Series outlet pipe saddle height is 43 inches (1,075 mm) above tank bottom (see Figure 1).

Supplemental Force

The minimum supplemental downward force required is included in Table 2 to allow custom buoyancy control methods. These values include a factor of safety of 1.5 applied to the calculated force required to restrain the tank. Custom-designed buoyancy control methods shall conservatively consider saturated conditions from the bottom-of-tank elevation to ground surface. As long as buoyancy control is provided that supplies the minimum weight listed in the table (for poured-concrete blocks or other methods designed by third parties), the tanks are calculated to be stable for the water height outside the tank and above the tank bottom and corresponding soil cover conditions. All Infiltrator strapping and fastening recommendations apply for custom-designed buoyancy control methods. Contact Infiltrator’s Technical Services Department with any questions regarding supplemental force requirements.

Contact Infiltrator Water Technologies’ Technical Services Department for assistance at 1-800-221-4436.
Compatible Devices and Products
Infiltrator tanks are compatible with the following products for buoyancy control:

- **Tie-down straps**: high-tensile-strength, 10,000 lb (4,500 kg) minimum capacity, nylon or polyester strapping with minimum 10,000 lb (4,500 kg) capacity is required for buoyancy control use with Infiltrator tanks. Place straps over the tank at specified locations only (see Figure 5). Tighten straps snugly with a ratchet or turnbuckle system to remove all slack and slightly pre-load the system. All connections, fittings, and hardware must be corrosion resistant or coated with epoxy or other corrosion-resistant materials to inhibit deterioration in the subsurface environment.
- **Concrete deadmen anchors**: concrete-filled plastic half pipe, precast parking bumpers, precast traffic barrier, or precast blocks. The weight of the deadmen anchors combined with the weight of soil above them provides buoyancy control when properly secured. Deadmen anchors are placed at the bottom of the tank excavation on opposite sides of the tank. The deadmen anchors are fastened to each other with tie-down straps placed over the tank at the locations specified for each tank model (see Figure 5).
- **Helical anchors**: Chance™ No-Wrench Screw Anchors with a 6-inch (150 mm) diameter flight, Class 7 or equal. These anchors rely on the shear strength of the soil combined with the weight of the soil above the anchor flight to provide holding strength. Proper installation is to 4 feet (1.2 m) below the bottom of the tank excavation and to within 5° of alignment with the strap alignment. Determine the proper locations for anchor installation to ensure that tie-down straps will be aligned properly for each tank model (see Step 3: Implementation), and follow the anchor manufacturer installation instructions.
- **Mid-Seam Concrete Collar**: cast-in-place concrete (minimum 3,000 psi compressive strength at 28 days and minimum 6% air entrainment).

**Concrete Deadmen Anchors**
Recommended concrete deadmen anchors include filled plastic half pipe, precast parking bumpers and traffic barriers, and precast blocks. The weight of the deadmen anchors combined with the weight of soil above them provides buoyancy control when properly secured. Deadmen anchors are placed at the bottom of the tank excavation on opposite sides of the tank. The deadmen anchors are fastened to each other with tie-down straps placed over the tank at the locations specified for each tank model (see Figure 5).

**Concrete-filled Plastic Half Pipe**
Use Schedule 40 PVC plastic pipe with a minimum inside diameter of 15 inches (375 mm) or HDPE corrugated pipe with a minimum inside diameter of 18 inches (450 mm) cut in half lengthwise. Fill with concrete having a minimum unit weight of 145 lbs/ft³ (2.32 metric tons/m³) reinforced with three equally spaced 40-grade, 1/2-inch (13 mm) diameter steel bars. Weight is 61 lbs/ft³ (91 kg/m³) minimum.

**Concrete Parking Bumper**
Use commercially available steel-reinforced parking bumpers with typical dimensions of 12 inches wide by 6 inches high (300 mm x 150 mm). Weight is 58 lbs/foot (86 kg/m) minimum.

**Concrete Traffic Barrier**
Use commercially available steel-reinforced concrete traffic barrier or equivalent. Typical dimensions include a 24-inch-wide base tapering to a 6-inch-wide top, with a height of approximately 32 inches (600 mm x 150 mm x 800 mm). Weight is 390 lbs/foot (580 kg/m) minimum.

**Precast Blocks**
Concrete precasters can fabricate blocks of various dimensions and weights. Blocks are often an affordable option if they satisfy the minimum weight requirements for use as buoyancy control (see Table 2 and the Supplemental Force section of Step 2 for more information).

**Concrete Collar**
A ballast may be constructed along the mid-seam of the tank using cast-in-place concrete (minimum 3,000 psi compressive strength at 28 days and minimum 6% air entrainment). Concrete shall be cast in contact with the exterior surface of the tank to allow interlock with sidewalk ribs and the mid-height flange. Reinforcing steel is not required, but may be added if desired.

**Step 3 – Implementation**
Effective buoyancy control of Infiltrator tanks requires careful preparation, thorough excavation, precise placement, secure strapping and proper backfilling, as described and illustrated below.

**Excavation Requirements**
It is recommended that the excavation width provide a minimum of 36 inches (900 mm) clearance beyond the tank on all sides when utilizing buoyancy control. This will allow sufficient space within the excavation to place anchoring equipment and fasten strapping. The excavation should provide a minimum 48-inch (1,200 mm) clearance beyond the tank when using Chance™ No-Wrench Screw Anchors to allow for room to properly install the screw anchors. The actual excavation size shall be determined by the installer. Refer to Infiltrator IM-Series Tank Installation Instructions for additional excavation procedures.

**Concrete-filled Half Pipe Construction**
Concrete-filled half pipe shall be supported with soil or other stabilizing means below the pipe haunches prior to concrete placement. The stabilization shall prevent the pipe from rolling during placement and curing of the concrete. Concrete shall be allowed to cure for a minimum of one day prior to tank backfilling.

**Placement of Deadmen and Anchors**
Concrete deadman anchors are to be installed at the bottom of the tank excavation, parallel to the long axis of the tank (see Figure 3).

**Figure 3: Plan View**

The deadmen should be placed close to, but not touching, the tank on both sides of the tank to allow the placement of backfill between the deadman anchor and tank sidewall (see Figure 4).
Strapping

Proper installation of straps over the tank is critical for tank stability under constant and fluctuating water conditions both inside and outside the tank. Straps must be placed at the specified strapping locations for each model, as illustrated in Figure 5. Strapping locations are embossed on the exterior surface of the tank with the following text: “SHIPPING /ANTI-BUOYANCY STRAP HERE.” The IM-Series tank strapping locations correspond to structurally reinforced areas of the tank body. Straps must never be placed over access openings, lids, or inlet/outlet piping. Straps must be tightened with a ratchet or turnbuckle system to remove slack and slightly pre-load the system.

STRAPPING NOTES:
1. The buoyancy control shall be centered across the straps (excludes helical anchors). The control shall extend a minimum of 6 inches (150 mm) beyond the maximum strap width (see Figures 3 and 5).
2. The minimum deadman length corresponds to the tank model-specific strap width plus 12 inches (300 mm).

Backfill and Cover

Place backfill between deadman anchor and tank sidewall to fully fill void and tank body corrugations. A minimum 6" layer (150 mm) of suitable cover material is required over all Infiltrator tank installations. Mound cover to direct surface water drainage away from the tank excavation footprint to prevent filling of the tank excavation with precipitation. Establish erosion-resistant vegetation within the tank installation footprint. Refer to Infiltrator IM-Series Tank Installation Instructions for complete backfilling and cover procedures.

General Specifications

• Prior to ground disturbance, check for subsurface obstructions and utilities in conformance with applicable regulatory requirements.
• Excavation safety provisions shall conform to applicable government regulations.
• Follow manufacturer instructions for all products and devices used for Infiltrator tank buoyancy control.
• Buoyancy control methods described herein do not account for unanticipated conditions such as surface flooding, temporary inundation or other natural occurrences, unintended removal of cover fill over tank, etc.
• Buoyancy control methods described herein are recommendations only; consult a professional engineer for customized designs, if desired.

Parts and Supplies

The parts and supplies necessary are to be purchased separately from the tank. All parts and supplies are either commercially available or available through Infiltrator’s network of tank distributors. Some parts may require fabrication on site using common construction practices.