תאגיד מי שמש בע"מ

מכרז מס' 4/24

מט"ש עמק האלה

תכנון, אספקת ממברנות וציוד נילווה, פיקוח על התקנתם,
הרצה, שירות ואחריות של מערך הMBR

כרך ב' – חלק 3 – המפרט המיוחד

תאגיד מי שמש

1. הוראות כלליות

1.1 תאור העבודה

תאור העבודה כמפורט בסעיף 1 של חלק 1 בכרך ב׳.

סוג הממברנות

המציע יהיה רשאי להציע את אחת משתי החלופות לסוג הממברנות.

חלופה א׳
סוג הממברנה - שטוחה (Flat Sheet Membrane) המוגדרת כסינון מיקרו פילטרציה כדוגמת תוצרת חב׳ KUBOTA או שוו״ע של יצרן אחר המייצר ממברנה שטוחה, בתנאים המפורטים המפרט הטכני.

חלופה ב׳
סוג הממברנה - סיב חלול (Hollow Fiber Membrane) המוגדרת כסינון אולטרא פילטרציה כדוגמת תוצרת חב׳ Veolia או שוו״ע של יצרן אחר המייצר ממברנה מסוג סיב חלול, בתנאים המפורטים המפרט הטכני.

הממברנות יהיו ארוזות במארזים מוכנים במפעל ומסופקות ביחידה מושלמת להתקנה. המארז יכלול את יחידות הממברנות, צנרת פלב״מ, פיזור אוויר גס על פני הממברנות, צנרת פלב״מ ליציאת קולחים מהממברנות וצינור מאסף, מסילות התקנה ותפסי התקנה לקירות, תפסים להנפת הממברנות באמצעות מנוף או עגורן, וכל הנדרש להתקנה מושלמת של הממברנות בתאים.

1.2 קבלנים נוספים

תשומת לב הקבלן מופנית לכך כי לפני, ו/או תוך כדי ו/או אחרי ביצוע עבודתו הוא, יועסקו באתר קבלנים נוספים (להלן ״**הקבלנים האחרים**״) כלהלן:

1.2.1 קבלנים לבצוע עבודות ההנדסה האזרחית והצנרת.

1.2.2 קבלנים נוספים/אחרים לאספקת ציוד אלקטרומכני ולפקוח על התקנתו.

1.2.3 קבלנים להתקנת הציוד האלקטרומכני ועבודות החשמל.

הקבלן יפעל במקביל, בצמוד ובלוח זמנים משולב ומתואם עם הקבלנים האחרים.

1.3 פיקוח באתר

לצורך ניהול פיקוח ותאום ביצוע העבודות, על כל מכללן, ימנה המזמין מפקח באתר מטעמו (להלן ״המפקח״).

המפקח ינהל את ביצוע העבודות, יתאם את עבודת הקבלן והקבלנים האחרים, יקבע לוחות זמנים, אבני דרך ושלבים לביצוע העבודות.

קביעתו תחייב את הקבלן ללא כל זכות ערעור גם אם לדעת הקבלן נגרם לו נזק כלשהו כתוצאה מהחלטות המפקח.

המפקח יהיה רשאי לזמן את הקבלן או מי שמוסמך מטעמו לישיבות אשר בהן, בין היתר, ייערך מעקב אחר ביצוע העבודות, יקבע סדר ביצוע עבודות לעתיד ושלבי ביצוע. מועד, תדירות ומקום ישיבות אלו יקבע ע"י המפקח. הקבלן מתחייב כי בישיבות אלו ישתתף נציג מוסמך מטעמו.

1.4 **<u>סוג החומרים והתאמה לתקנים</u>**

הקבלן יעשה שימוש רק בחומרים מהמין המשובח ביותר.

חומרים שלגביהם קיימים תקנים יתאימו בתכונותיהם לתקנים האמורים ובכל מקרה שהדבר אפשרי, יישאו תו תקן.

הקבלן לא יעשה שימוש אלא בחומרים שנבדקו ואושרו ע"י המפקח. יודגש כי עצם הבדיקה והאישור ע"י המפקח לא יסיר מאחריות הקבלן בהתאם למפורט במסמכי המכרז השונים.

1.5 **<u>לוח זמנים לאספקת הציוד</u>**

לוח הזמנים שיפורט להלן מתייחס לפרק הזמן שממועד מתן צו התחלת עבודה (שייקרא "**הוראת אספקה**") ועד מועד אספקת הציוד לאתר העבודות או למחסני המזמין.

פרק הזמן שיפורט להלן כולל את כל הפעולות הנדרשות לבצוע ע"י הקבלן הזוכה בקשר עם הציוד ובכלל זאת: התכנון, הכולל חישובי התהליך, הכנת דיאגרמות P&ID, תכנון אדריכלי של מבנה המכונות ותאי ממברנות, הזמנת הציוד אצל היצרנים, טיפול ברשיונות היבוא, הכנת תכניות הרכבה ופרטים, אישור התכניות ע"י המזמין (המזמין יבדוק ויאשר את תכניות הקבלן בתוך פרק הזמן הנקוב בפרק זה), ייצור הציוד, יבוא הציוד לארץ, הובלתו לאתר העבודות וכו', פרק הזמן להלן אינו כולל את משך זמן הפקוח על הרכבת הציוד באתר.

מובהר בזאת כי ישנה חשיבות עליונה לביצוע אספקת הציוד בהתאם למועדים המצויינים לעיל ועל המציע לקחת אותם בחשבון בעת הגשת הצעתו.

הוראת האספקה תינתן לקבלן, עפ"י פרק הזמן המפורט בפרק זה ותציין את המועד בו על הציוד להגיע לאתר. הקבלן לא יהיה רשאי להקדים את מועד האספקה שנקבע בהוראת האספקה אלא באישור מראש ובכתב של המפקח.

1.6 **<u>לוח זמנים ושלבי ביצוע מפורטים</u>**

סמוך לאחר מתן צו התחלת עבודה יקבע המפקח שלבי ביצוע ולוחות זמנים מפורטים ומתואמים לעבודת הקבלן ולעבודת הקבלנים האחרים.

קביעת המפקח תהא סופית ובלתי ניתנת לערעור.

הקבלן יהיה חייב לעמוד בלוחות הזמנים ושלבי הביצוע שיקבע המפקח ולא תהא לו זכות לתבוע או לקבל פיצוי או תשלום כל שהוא בגין החלטות המפקח.

פעולה	משך הפעולה מהודעה על זכיה
חתימת חוזה	שבוע
חישובי תהליך, פרטי ציוד המוצע, תכנון אדריכלי של מבני השרות ותאי הממברנות	12 שבועות
בדיקה ואישור חישובי תהליך, ציוד ותוכניות	6 שבועות
אספקת ציוד נלווה למעט ממברנות – לפי הוראה והתראה של המזמין בשיתוף הקבלן	בהתראה של 180 יום
אספקת הממברנות – לפי הוראה והתראה של המזמין בשיתוף הקבלן	בהתראה של 50 שבועות

1.7 <u>ניהול הפרויקט באמצעות מערכת ניהול פרויקטים ממוחשבת</u>

הפרויקט ינוהל במערכת ניהול פרויקטים ממוחשבת המופעלת אצל המזמין, הקבלן הזוכה מחוייב להעביר את כל מסמכי הפרוייקט הכוללים בין השאר , מכתבים, סכומי דיון, בקשות אישורים לאספקת ציוד, תוכניות, מפרטים, הגשת חשבונות, הגשת בקשות לתשלומים נוספים, דוחות פיקוח עליון וכו׳ באמצעות מערכת ניהול הפרויקטים. הקבלן ירכוש את הרשיונות להפעלת מערכת הניהול לעבודה זו בעלות שתוגדר ע״י המזמין, עלות רכישת הרשיונות תיכלל במחירי היחידה השונים ולא תשולם כל תוספת עבור רכישת הרשיונות להפעלת המערכת לעבודה זו. למען הסר ספק – לא תתקבלנה כל צורת תקשורת ובין השאר דווחי הקבלן, חשבונות, יומני עבודה, בקשות לאישורי ציוד וכו׳ שלא באמצעות מערכת ניהול הפרויקט.

2. <u>פרק 2 - אספקת ציוד אלקטרומכני</u>

2.1 <u>הוראות כלליות</u>

2.1.1 תיאור כללי של הציוד האלקטרומכני שיסופק, מפורט בסעיף 1 של חלק 1 בכרך זה.

מפרט מיוחד עם פרוט מלא של מפרטי הציוד ותאור הציוד הדרוש על כל מרכיביו, ניתן בהמשך במסמכי המכרז (בשפה האנגלית).

2.1.2 <u>נ ס פ ח י ם</u>

עם הצעתו יגיש הקבלן תיאור מלא ומפורט של הציוד שהוא מציע בהתאם למפרטים.

יודגש, כי הצעת הקבלן צריכה לכלול ציוד העונה ומתאים לכל דרישות המפרטים בעברית ובאנגלית. המזמין יהיה רשאי, אך לא חייב, להתעלם מאי התאמות מינוריות בין הצעת הקבלן ובין דרישות המפרט על פי שקול דעתו הבלעדי והמוחלט.

כאשר מצוינת רשימה של מספר יצרנים ומודלים כחלופות לציוד מסוים הרי שהקבלן יכול לכלול בהצעתו רק יצרן ו/או מודל מהרשימה הנ״ל.

במידה והקבלן מעוניין להגיש הצעה חלופית לציוד, השונה במהותה ואינה שוות ערך לציוד שהוגדר, הוא חייב להגיש הצעה לציוד הנדרש עפ״י המפרטים וכן הוא רשאי לצרף בנוסף להצעתו לציוד העונה לכל דרישות המפרט, גם הצעה הכוללת את פרטי הציוד החלופי. לא תתקבל הצעה שלא תכלול הצעה לציוד העונה לדרישות המפרט. **ההחלטה האם לדון בהצעה החלופית נתונה לשיקול דעתו הבלעדי של המזמין**.

2.1.3 <u>ב י ט ו ח</u>

מבלי לגרוע מהאמור לענין זה בחוזה, המציע ידאג לביטוח הציוד והאביזרים מפני כל הנזקים שעלולים להיגרם להם, כולל ביטוח ימי או אווירי במידת הצורך וכולל ביטוח בארץ, עד למועד השלמת התקנת הציוד והרצתו, כולל פרק הזמן בו יאוחסן הציוד באתר כמפורט בסעיף 2.1.7.4. פוליסת הביטוח תהיה לטובת הקבלן ולטובת המזמין, ותימסר למזמין במעמד חתימת החוזה.

לא ישולם לקבלן עבור כל נזק, גניבה או אובדן של ציוד כלשהו. במידה ויהיה נזק או אובדן כנ״ל יספק הקבלן על חשבונו את הציוד הניזוק או החסר. עבור הביטוח לא ישולם בנפרד ומחיריו כלולים במחירי היחידה שבהצעת הקבלן.

2.1.4 <u>טיב החומרים והייצור</u>

כל פריט או מכלול ציוד שיוצע, יהיה אך ורק מתוצרת מוכרת, ידועה ובעלת מוניטין בארץ ו/או בעולם.

הציוד יתאים מכל הבחינות לעבודה במתקני ביוב בתנאים קשים, הן בפעולה רצופה והן בפעולה לסירוגין. יתקבל רק ציוד אשר הוכיח את עצמו בפעולה משביעת רצון בתנאים דומים, הכל לפי קביעת המזמין.

במידת הצורך, רשאי הקבלן לפני הגשת הצעתו לברר בעצמו פרטים הנוגעים לטיב השפכים הצפויים במכון הטיפול, או לתנאים אחרים העשויים להשפיע על פעולת וקיום הציוד אותו יספק.

לא תתקבל כל טענה של הקבלן הזוכה בדבר השפעת התנאים במכון על תפקוד וקיים הציוד אותו סיפק, והקבלן אחראי על כך שהציוד יפעל בתנאים הקיימים, כמתחייב על ידו.

כל החלקים הדורשים החלפה תקופתית יהיו נוחים לגישה תוך צורך מינימלי בפירוק המתקן. כל יחידות הציוד הזהות יהיו ברות חליפין, הן כיחידה שלמה והן בחלקיה המרכיבים.

כל העבודה תבוצע באורח מקצועי מעולה בהתאם למיטב הנוהג החדיש המקובל בייצור ציוד ממין משובח, על אף כל חסרון או השמטה בדרישות המפרט.

כל החומרים המשמשים בייצור הציוד ובהתקנתו יתאימו מכל הבחינות להוצאה האחרונה של התקנים הישראליים, ו/או תקנים אירופאיים או אמריקאיים. באין תקן מוזכר כנ"ל במפרט המיוחד יציין המציע ברשימת הנספחים את התקן שלפיו הוא עומד לספק את החומר הנדון.

כאשר מוצע לספק חומר כלשהו לפי תקן שונה מזה שמוזכר במפרט, יהיה טיב החומר שווה לזה שמתואר בתקן שבמפרט או עולה עליו, ובמקרה כזה יצורפו להצעה שני עותקים של אותו תקן. קבלת הצעה המבוססת על תקנים כאלה (אם תתקבל) לא יהיה בה כדי לחייב את המזמין ו/או המפקח לאשר כל תקן שיימצא נחות ביחס לתקן המקורי שאותו הוא בא להחליף. המפקח יהיה רשאי לפסול כל חומר, חלק או עבודה אשר יפלו בטיבם מדרישות התקן המקורי המוזכר במפרט, ועל המציע יהיה לתקן כל ליקוי הנובע מכך על חשבונו הוא. לפני ייצור הציוד יגיש המציע לאישור המפקח את רשימת כל התקנים הרלבנטיים.

כל החומרים ייבחרו מהטובים ביותר שאפשר להשיגם לשימוש לו הם מיועדים, מבחינת החוזק, הגמישות, הקיים, ההתנגדות לקורוזיה בהתחשב במיטב הנוהג ההנדסי המקובל.

החומרים שייבחרו יתאימו בדרך כלל לדרישות המפורטות להלן ותיאורם המדויק טעון אישור המפקח. אחרי קבלת הצעתו יגיש המציע למפקח במידה והלה ידרוש זאת, תעודות המראות את תוצאות הבדיקות שנעשו בחומרים המיועדים לשמש בייצור הציוד. כל הבדיקות האלה ייעשו על חשבון הקבלן. נוסף לכך יהיה המפקח רשאי ליטול דוגמאות של חומרים המיועדים לשימוש בציוד ולערוך בהן בדיקות כפי שימצא לנחוץ.

כל החלקים הטבולים הנעים וכן הפינים והכושים של חלקים אלה וחלקים אחרים הבאים במגע אתם יהיו ממתכת בלתי מחלידה, וחלקים כאלה אשר יופיעו בהם סימנים של שיתוך (קורוזיה) תוך תקופת הבדק יחליפם הקבלן על חשבונו בחלקים מחומר בלתי מחליד מתאים. בבחירת סוגי המתכות השונים יוקפד על כך שהשפעת השיתוך הדו-מתכתי תוקטן ככל האפשר. האמור לעיל יחול גם על חלקים נעים החשופים למזג האוויר. כל הברגים, האומים והכבלים הכלולים בציוד, המיועדים לעיגון הציוד או מחברים בין חלקי ציוד יהיו אך ורק מפלב״מ 316, אלא אם צויין אחרת.

2.1.5 <u>ג י מ ו ר</u>

הגימור והמראה החיצוני של כל הציוד יהיו בהתאם לאורח מקצועי מעולה ולדרישות סעיף זה.

כל החלקים מיציקת ברזל או פלדה המותקנים מעל למפלס הרצפה או במקום אחר בהם הם גלויים לעין יקבלו גימור חלק ומבריק ע״י מילוי כל השקעים ושפשוף יסודי של כל השטח לפני הצביעה במספר שכבות. גימור זה יידרש במשאבות, במנועים וכו׳.

צינורות בני קוטר קטן, ברזים ושלטים יהיו מצופים כרום או עשויים מפלב״ם או חומר אחר השומר על מראהו הנאה ללא צורך בניקוי. השפות של אוגני צינורות ופינותיהם ילוטשו והשטחים מסביב לחורי הברגים ייחרטו. גלגלי יד יהיו מלוטשים ומצוחצחים.

2.1.6 <u>בדיקת הציוד במפעל, בדיקה ע״י המזמין ומבחני עדות</u>

לפני אריזת הציוד כולל הממברנות, על היצרן לבצע בדיקת הציוד על כל מכלליו. הבדיקה כוללת הרכבת כל מכללי הציוד במפעל היצרן (כולל גם מנועים ותמסורות המיוצרים ע״י יצרנים אחרים) ווידוא כי המכלול השלם וכן חלקיו יוצרו עפ״י המפרטים ובמידות הנכונות.

מזמין העבודה רשאי לבדוק את כל הציוד בכל שלבי הייצור הן בעצמו, בעזרת מהנדסיו או באמצעות בודק מוסמך בלתי תלוי שימונה על ידו לצורך זה. המציע מתחייב לספק את כל המסמכים המעידים על נוהל בקרת האיכות וכן מסמכים נוספים כפי שיידרש ע״י הבודק, לאפשר גישה חופשית לאתר היצור, לארגן ולתאם סיורים באתרים בהם מותקן ציוד דומה ולסייע ולשתף פעולה בכל דרך שתידרש כדי לבצע את הבדיקות. חלק מבדיקות אלו הוגדרו בפרקי המפרט השונים והן מהוות פירוט נוסף לסעיף זה.

כל ההוצאות הכרוכות בהכנת מסמכים המעידים על תהליך הייצור במפעל ועמידתו בתקנים, ובהכנת הציוד לבדיקות תהיינה על חשבון הקבלן ולא ישולם עבורן בנפרד.

עלות ביצוע הבדיקה על ידי נציגי המזמין או על ידי בודק מוסמך בלתי תלוי כולל : כרטיסי טיסה, אשל, לינה ושכר הבודק, תחול על המזמין. במידה ובדיקת הציוד תצביע על אי התאמתו לדרישות המכרז, עלות הבדיקה החוזרת על כל מרכיביה (כולל מרכיבים שעלותם חלה על המזמין בבדיקה הראשונה), תחול על הקבלן.

2.1.7 <u>אריזה וסימון</u>

2.1.7.1 <u>אריזה</u>

אחרי שהציוד הורכב ונוסה במפעל הייצור כאמור לעיל ולפני שיישלח לתעודתו, תינתן לציוד הגנה יעילה נגד שיתוך ונזק מקרי לרבות נזק העשוי להיגרם ע״י שרצים, אור שמש חזק, גשם, חום רב, אויר לח או רסיסי מי ים. שטחים בלתי צבועים העלולים להעלות חלודה יכוסו לפני המשלוח במשחת מגן.

במקרה של משלוח מעבר לים תתאים האריזה להובלה ימית ולטלטול קשה בדרכים וכן לשהיית הציוד ברציפים גלויים. בכל מקרה יהיה הקבלן אחראי לאריזת הציוד באופן שהוא יגיע לייעודו שלם ובמצב טוב. הקבלן יישא בכל הוצאות האריזה כגון הספקת והכנת ארגזים, תיבות פסי פלדה וחומרי אריגה כגון יריעות פוליאסטר, חומרים סופגי רטיבות וכיו״ב.

מיד עם משלוח הציוד, יועברו העתקי תעודות המשלוח לידי המזמין.

2.1.7.2 <u>סימון</u>

כל ארגז וכל חבילה יסומנו סימון קריא ובל יימחה של הנתונים הבאים.

- שם המפעל המייצר
- תיאור הציוד
- מספר היחידות בארגז ובחבילה

2.1.7.3 <u>הובלה לאתר ופריקת הציוד באתר</u>

הובלת הציוד לאתר העבודות או למחסנים כפי שיקבע וכל הפעולות הכרוכות באחסונו ייעשה ע״י הקבלן ועל חשבונו. הציוד יובל לאתר או למחסני המזמין ויאוחסן שם במקום שיורה המפקח ובאופן שיבטיח כי הציוד לא יפגע כתוצאה מאחסנתו.

הקבלן יוביל את הציוד לאתר לאחר תאום מראש עם המפקח. הקבלן יפרוק ציוד באתר אך ורק בנוכחות המפקח.

2.1.7.4 <u>אחסון</u>

האחסון יעשה באתר המכון או במחסנים כפי שיסוכם. במידה וקיימות הנחיות מפורשות של יצרן הציוד לאחסונו של הציוד, יפעל הקבלן בהתאם להנחיות אלו. משך האחסון - עד גמר ההתקנה או עד משיכת הציוד ע"י הקבלן המתקין. האחסון יעשה במשטחים פתוחים ומפולסים במקום שיוקצה ע"י המפקח. הציוד יאוחסן בצורה מסודרת, עפ"י הוראות המפקח, בתוך מכולות מוגנות או בתוך ארגזים מוגנים מפני אבק, רוח, גשם וכו'. ציוד בעל מימדים גדולים, שלא ניתן לאחסנו במכולות, יאוחסן על גבי משטחים מורמים 30 ס"מ מעל הקרקע. הציוד ייעטף היטב ביריעות פוליאתילן שיגנו עליו מרטיבות, שמש, גשם לחות וכו'. כל הפעולות הדרושות לאחסון וכל עלותן חלה על הקבלן. אחריות לנזקים עקב אחסון לקוי תחול על הקבלן.

2.1.8 <u>תוכניות</u>

2.1.8.1 <u>תכניות הרכבה ופרטים</u>

כל התכניות המפורטות להלן יוגשו ע"י הקבלן הזוכה במדיה מגנטית (קבצי PDF, DWG וקבצי תלת מימד בפורמט STP, RFA או פורמט אחר שיאושר ע"י המתכנן), וכן בשלושה עותקי ניר.

בהתאם ללוח הזמנים המפורט בפרק זה, יגיש הקבלן תכנון מפורט על כל מרכיביו לאישור המזמין.

בהתאם ללוח הזמנים המפורט בפרק זה, יגיש הקבלן לאישור המפקח תכניות הרכבה ופרטים כלהלן:

א. תכניות המראות את הסידור הכללי של פרטי הציוד השונים כולל העמדה מוצעת של הציוד, המרווחים בין פריטי הציוד השונים וכן פרטים וחתכים, עם ציון של המידות ואת כל הפרטים של הציוד וציוד העזר.

ב. תכניות הרכבה מפורטות של כל פריט ופריט של הציוד המראות במידת הצורך גם את משקל הציוד, החומרים וצורת הגימור וכן את ההנחיות לגבי היסודות.

ג. תכניות עבודה לציוד המצריך חיבורים חשמליים ו/או מכניים המראות את יחידות הציוד במצב המתוכנן להתקנה ואת פרטי החיבורים הדרושים, תוך ציון מיקומם ההדדי ומיקומם במבנה.

ד. תכניות עבודה מפורטות של כל הצנרת המראות את המיקום והרום של כל הצינורות, המחברים, האביזרים, המגופים והשסתומים וכן את צורתם ומקומם של מתלים, תמיכות וכיו"ב.

ה. שרטוטי כל הפרטים של מובלים, תעלות, פתחים, חריצים, חורי ברגים וכו' שיש לכללם בעבודות הבניה. חורים וחריצים אלו יוכנו ע"י הקבלן שיבצע את עבודת ההנדסה האזרחית.

ו. פרטים על העומסים התמידיים והזמניים בנקודות ריכוז העומס ועל המאמצים במבנים הנגרמים ע"י עומסים זמניים, תיאורם וגודלם של תמיכות ומבנים זמניים המותקנים במבנה כדי להקטין את המאמצים במבנה בעת התקנת הציוד וכן חישובים המראים שמתקני ההרמה הזמניים לא יגרמו נזק למבנה.

ז. תכניות לוחות החשמל והבקרה, תכנת הבקרה.

ח. כל תכנית נוספת הדרושה לצורך עבודת הקבלן שירכיב את הציוד המסופק.

כל המסמכים והתכניות יוגשו בשפה האנגלית בלבד.

המזמין יבדוק את התכניות שהגיש לו הקבלן, ויחזיר אליו לאחר אישורו, או עם דרישה לשנויים הנראים לו נחוצים. הקבלן יתקן את התכניות ויגישן לאישור מחודש תוך 10 ימים. תכניות הרכבה אלו תשמשנה כבסיס להכנה ולהשלמת תכניות המתקן, כולל ההנדסה האזרחית, הצנרת והחשמל, ותשמשנה בעתיד את הקבלן שירכיב את הציוד המסופק. לאחר השלמת תכניות אלו ע"י המתכנן מטעם המזמין הם יועברו לאישור הקבלן. האחרון יאשרם בחתימתו ובחתימת יצרן הציוד המקורי כמתאימים לדרישות הציוד.

2.1.9 ברורים והבהרות

לפני הגשת ההצעה רשאי המציע לבקש מאת המזמין הבהרות והסברים נוספים בקשר לציוד הנדרש כמפורט בתנאי המכרז.

לאחר מסירת העבודה לקבלן לא יורשה הנ"ל לשנות את הציוד (יצרן, דגם, פרטים טכניים) שהוצע על ידו במעמד הגשת ההצעה והוא יחויב לספק את הציוד שהוצע על ידו, אלא אם כן ידרוש המפקח שינוי או החלפת הציוד המוצע על ידי המציע, אשר לדעת המפקח אינם מתאימים לנדרש ואז יעשה הדבר ללא כל תשלום נוסף על מחירי ההצעה.

2.1.10 הוראות תפעול

הקבלן הזוכה יספק למזמין ספר המכיל הוראות הרכבה, תפעול ותחזוקה לציוד שסופק בשלושה עותקים. החוברת תסופק גם במדיה מגנטית (קבצי DOC DWG וכו'). החוברת תכלול הוראות מפורטות בדבר התקנת הציוד, הרצתו, ניסויו, החזקתו ותפעולו. חשיבות מירבית תיוחס לשלמות הגשת החומר ולבהירותו. החומר שיוגש יהיה כתוב בשפה **העברית והאנגלית**.

במידה וההוראות שיוגשו לא יענו על הדרישות המפורטות לעיל, המפקח יהיה רשאי לפסול את הוראות התפעול המוגשות, כולן או מקצתן, ולדרוש תיקונן או עריכתן מחדש להנחת דעתו.

החוברת תחולק לפרקים בהתאם לסוגי הציוד. כל פרק יכלול את הסעיפים הבאים:

- תיאורו של כל חלק ופריט של הציוד
- הוראות הרכבה ופירוק
- הוראות לניסוי הציוד והרצתו
- הוראות תפעול
- הוראות תחזוקה שוטפת
- הוראות לגילוי תקלות
- נתוני מידע והוראות בעניינים שונים
- רשימת חלפים ונוהל הזמנתם

יודגש בזאת כי לא יתקבל אוסף סתמי של פרוספקטים או חוברות פרסומת. יודגש בנוסף, כי הגשת החוברת ואישורה ע"י המפקח הינו תנאי להגשת ואישור חשבון סופי.

2.1.11 כלים מיוחדים

המציע יספק שתי (2) מערכות שלמות של כלים לשם הרכבה, התקנה, פירוק, אחזקה ותיקון של פריטי ציוד המסופקים עפ"י החוזה וזאת עבור כל פרק ציוד. הכלים יהיו מאיכות מעולה מצופים צפוי מגן. עבור אספקת הכלים לא ישולם בנפרד.

2.1.12 אחריות ושרות

הקבלן יהיה אחראי אחריות מלאה ובלתי מסויגת ובלתי מותנית בתנאי כלשהו לתקינות כל הציוד שסופק על ידו במשך 24 חודשים מתום שלב ההרצה. הקבלן יבוא בדברים עם יצרני הציוד ויקבל הסכמתם וגיבויים המלא למשכי האחריות המצויינים לעיל, אף אם פרקי הזמן חורגים מתקופת האחריות המוענקת בדרך כלל על ידי יצרני הציוד. כל חלקי החילוף והתיקונים הנדרשים יסופקו במהלך תקופת האחריות ע"י הקבלן ועל חשבונו.

עבור הממברנות תינתן אחריות מלאה למשך של 7 שנים בסה"כ (שנתיים במשך תקופת הבדק בדומה לכלל הציוד, ו-5 שנים נוספות מעבר לכך).

זמן התגובה של הקבלן לקריאת שרות בתקופת האחריות, לא יעלה על 48 שעות מרגע הקריאה.

זמן האספקה של כל חלף שהוא בתקופת האחריות לא יעלה על 10 ימים ממועד ההודעה על התקלה.

מובהר בזאת כי ערבות הבדק וערבות הבדק לממברנות שמסר הקבלן הזוכה למזמין בהתאם לתנאי המכרז/ חוזה ישמשו להבטחת התחייבות זו של הקבלן וכן להבטחת יתר ההתחייבויות של הקבלן בתקופת הבדק והאחריות.

הקבלן מחוייב לזמן נציג מוסמך ובקיא של יצרן הממברנות מחו"ל לביקורת על הממברנות ואופן הפעלתן לאחר שנה מתום הרצת המתקן והתחלת הפעלתו הסדירה.

מטרת הביקורת היא לבדוק את מצב הממברנות ולוודא כי הן מופעלות בהתאם להוראות היצרן. הקבלן ימציא למזמין דו"ח כתוב על הביקורת שנערכה.

למען הסר ספק יודגש כי שום ממצא בביקורת זו לא יפחית מאחריות הקבלן כאמור לעיל.

עבור ביצוע הביקורת כאמור לעיל, ע"י נציג יצרן הציוד, ישולם לפי הסעיף בכתב הכמויות.

2.2 **מפרטי הציוד ותאור הציוד המוצע**

מפרטי הציוד הטכני ניתנים באנגלית. כמו כן כולל המפרט חלקים שעל הקבלן למלא, המהווים חלק בלתי נפרד מהמפרטים.

2.3 **אופני מדידה ותשלום כלליים עבור אספקת ציוד אלקטרומכני**

2.3.1 כללי

מחיר אספקת הציוד יכלול את כל הפריטים המתוארים והמפורטים במפרט המיוחד של פרקי הציוד ואת כל הדרוש על מנת לקבל מערכת מכנית-חשמלית ברמה הגבוהה ביותר למעט אם צויין באופן מפורש כי פריט ציוד כלשהו איננו כלול במסגרת הציוד המסופק.

2.3.2 <u>ת כ נ י ו ת</u>

בעבור התכנון בכללותו לרבות הגשת עבודה ופרטים להם המציע נדרש עפ״י חוזה זה לא ישולם בנפרד ומחירם יהיה כלול במחירי היחידה השונים.

2.3.3 <u>הוראות תפעול</u>

עבור הספקת חוברות הוראות תפעול לציוד המתקן לא ישולם בנפרד והמחיר יהיה כלול במחירי היחידה השונים, עבור לימוד של הפעלת הציוד וצוות המט״ש, לא ישולם בנפרד והמחיר יהיה כלול במחירי היחידה השונים.

2.3.4 <u>אספקת ציוד</u>

בנוסף למצוין בסעיפים לעיל ביחס לכל פריט ציוד, יכלול מחיר אספקת הציוד את האמור להלן:

2.3.4.1 עריכת בדיקות ציוד ומבחני עדות כמפורט בסעיף 2.1.6, למעט העלות החלה על המזמין כמפורט בסעיף הנ״ל.

2.3.4.2 אריזה, סימון ומשלוח הציוד כמפורט.

2.3.4.3 ביטוח הציוד כמפורט.

2.3.4.4 תשלום כל המיסים, האגרות, תשלומי המכס ותשלומים אחרים החלים על הציוד.

2.3.4.5 אספקת מערכות מושלמות של יחידות הציוד לפי המתואר בתכניות, במפרטים ובכתב הכמויות, כולל מערכות מושלמות של הציוד, כבלי חשמל אורגינליים ובאורך מספיק מהיחידות ועד לקופסת חיבורי החוץ (במידה ונדרש), חומרי עזר, פחיות איזון, ברגים, אומים ודסקיות וכל שאר האביזרים הדרושים לצורך התקנה מושלמת של הציוד, כל זאת כאשר כל פריטי הציוד צבועים כנדרש במפרטים.

2.3.4.6 הובלת הציוד לאתר או למחסני המזמין ואחסנתו בהתאם להוראות היצרן ובהתאם למצויין במפרט המיוחד לעיל, עד להתקנתו במבנים השונים.

2.3.4.7 אספקת מערכות כלים כמפורט, עבור כל פרק ציוד.

2.3.4.8 אחריות על הציוד כמוגדר במסמכי החוזה.

התשלום עבור אספקת הציוד יהיה לפי יחידות או מכלולים בסיווג סוג הציוד, כמפורט בכתב הכמויות.

3. <u>פיקוח על התקנת הציוד ועל הרצתו</u>

3.1 <u>כ ל ל י</u>

בניית המבנים בהם יותקן הציוד שיסופק ע״י הקבלן תעשה ע״י קבלן ההנדסה האזרחית מטעם המזמין. ההתקנה וההרצה של הציוד יעשו ע״י קבלן ההתקנות מטעם המזמין. הקבלן המספק את הציוד יאשר את תכנון ההנדסה האזרחית של המבנים הקשורים בציוד המסופק על ידו, כדי לאשר למזמין כי העבודות המבוצעות ע״י הקבלנים האחרים נעשות כהלכה וכי אין מניעה להרכיב את הציוד ולהפעילו.

הפיקוח שיעשה ע״י הקבלן המספק את הציוד, כפי שיפורט להלן, נותן בידיו את כל הכלים כדי לבדוק ולבקר את עבודת הקבלנים האחרים, לוודא כי זו בוצעה כהלכה, לדרוש תיקונים עפ״י הצורך ולקבל על עצמו את האחריות המלאה על הציוד כנדרש בחוזה זה.

למען הסר ספק מובהר בזאת כי לא תוכר כל טענה של הקבלן הקושרת כשל של ציוד לביצוע לקוי של הקבלנים האחרים.

בנוסף לפיקוח שיבוצע ע״י הקבלן יבוצע גם פיקוח ע״י נציגים מוסמכים ובקיאים של יצרני הציוד .
הקבלן מצהיר ומאשר בזאת כי ידוע לו שתקופת ההקמה עלולה להתעכב ו/או להתארך מסיבות כלשהן, בין שהינן בשליטת המזמין ובין שאינן בשליטתו, לרבות עקב מעשים ו/או מחדלים של קבלן הנדסה אזרחית ו/או קבלן ההתקנות. הקבלן מתחייב לבצע את שירותי הפיקוח על התקנת הציוד כאמור להלן בכל מועד שהוא. הקבלן לא ידרוש והמזמין לא ישלם כל תוספת מחיר, לרבות בגין בטלה, ריבית וכיוצ״ב במקרה של עיכוב במועד המשוער לביצוע שירותי הפיקוח.

3.2 <u>פיקוח על ההרכבה ע״י הקבלן</u>

השירותים שינתנו ע״י הקבלן כוללים בין היתר:

3.2.1 מתן הוראות התקנה, כולל אספקת כל ההסברים בכתב ובע״פ והשרטוטים הדרושים לכל פריט ציוד המסופק על ידו, בטרם יוחל בהתקנה ע״י קבלן ההתקנות.

3.2.2 מתן מידע נוסף והוראות הקשורות להתקנת הציוד ככל שיידרש ע״י המפקח או קבלן התקנת הציוד. המפקח יהיה רשאי לזמן את הקבלן או נציג מטעמו לתת הוראות התקנה בכל זמן שיידרש וקבלן מתחייב להגיע בכל עת שיוזמן.

3.2.3 בדיקה ופקוח, ע״י נציג מוסמך ובקיא של הקבלן על כל פריט ציוד תוך כדי ולאחר התקנתו. הקבלן יאשר בכתב וזאת עבור כל פריט ציוד שיסופק על ידו, כי ההתקנה הושלמה לשביעות רצונו ובהתאם לכל הוראות היצרן המקורי של הציוד וכי אין מניעה לבצע הרצת הציוד והכנסתו לפעולה סדירה.

3.2.4 הקבלן ידווח למזמין או לנציג מטעמו באופן שוטף, צמוד לאירועים ובכתב על כל תקלה או טעות בעבודות ההנדסה האזרחית או בהתקנת הציוד ע״י קבלן ההתקנה תוך פרוט מהות הליקוי ואופן התיקון ו/או השלמת ההתקנה הדרושים באופן

שתבוצע לשביעות רצונו. בתום התיקונים הנדרשים יודיע הקבלן בכתב למפקח כי התיקונים בוצעו לשביעות רצונו.

3.3 **<u>פיקוח על הרצת הציוד</u>**

בתום התקנת הציוד ואישור הקבלן בכתב לכך שההתקנה התבצעה לשביעות רצונו, תיערך הרצת ציוד. ההרצה תיערך על ידי קבלן התקנות הציוד בפיקוח הקבלן **ובנוכחות נציג מוסמך ובקיא של יצרן הממברנות.** בסעיף זה נכללים בין היתר:

3.3.1 מתן הוראות הרצה והכנסה לפעולה תקינה של כל פריט ציוד.

3.3.2 בדיקה ופקוח ע״י נציג מוסמך ובקיא של הקבלן ושל יצרן הציוד כי הציוד מורץ כהלכה לשביעות רצונו המלאה ובהתאם להוראות יצרן הציוד. במקרה ובזמן ההרצה מתגלות תקלות כלשהן והקבלן אינו נוכח באותו מועד, רשאי המפקח לקרוא לקבלן או לנציגו ועל הקבלן להגיע לשטח מידית ולתת הוראות לפתרון התקלה.

3.3.3 **הקבלן יידרש לאשר** בכתב, כי הרצת הציוד הסתיימה ואין כל מניעה להפעיל את הציוד באופן מלא ושוטף ולקבל את האחריות עליו כאמור בסעיף 2.1.12 לעיל.

3.4 **<u>פיקוח על ידי יצרן הציוד על ההתקנה, על ההרצה ועל ההפעלה</u>**

כאמור לעיל, הרצת הציוד תתבצע בנוכחות נציג מוסמך ובקיא של הקבלן ושל יצרן הציוד.

הקבלן שיספק את הציוד הנ״ל מתחייב לזמן לצורך כך את יצרני הציוד (במידה ויש יותר מיצרן אחד, יש לזמן נציג מכל יצרן). יצרנים אלו יבצעו פיקוח על ההתקנה וההרצה, כל אחד על הציוד שסופק ע״י חברתו, וזאת בנוסף לפיקוח שיבוצע ע״י הקבלן.

למען הסר ספק, בכל מקום בו נדרש או שישנה התייחסות לפיקוח של היצרן הכוונה היא ליצרן הציוד (מהארץ או מחו״ל) ולא לנציגו/סוכנו של יצרן זה בארץ.

מחוייבות הקבלן בסעיף זה תפוצל ל- 2 מועדים שונים - לפעולת הפיקוח על ההתקנה, ולפעולת הפיקוח על ההרצה. בנוסף, בחלק מהפרקים יידרש בנוסף גם פיקוח על ההפעלה בתום שנה של הפעלה (ראה סעיף 2.1.12 לעיל).

3.5 **<u>ספר מתקן ואימון צוות המט״ש להפעלת מערכת הממברנות</u>**

הקבלן יכין ספר מתקן לתיעוד המערכות שסופקו על ידו ונהלי תפעול ותחזוקה. ספר התפעול והתחזוקה יופק בהתאם למפרטים ולהוראות היצרנים בעותק קשיח ובמדיה מגנטית לפחות בשלושה העתקים.

הספר יכלול את כל התוכניות, התשתיות, הציוד, המכשור והאביזרים שסופקו על ידו.

א. תיאור הציוד ופרמטרים לתכנון.
ב. תרשימי זרימה ושרטוט צנרת.
ג. סכמות מערכת החשמל והבקרה.
ד. הוראות הפעלה.
ה. ספר בחינות קבלה (TEST PROCEDURE).
ו. הוראות אחזקה מונעת למערכות ולפריטי הציוד.
ז. הוראות תיקון ושיפוץ.
ח. פריטי חלקי חילוף.
ט. מערך שרטוטי עבודה מפורטים.
י. המלצה למלאי חלקי חילוף לאחזקה לתקופה של שנתיים, כולל מספרי יצרן, שם יצרן והתייחסות לשרטוט/ספר אחזקה בהם מפורטים החלקים.

הקבלן מתחייב לבצע הדרכה של מספר ימים ע״י יצרן הממברנות ויצרני הציוד הנילווה לעובדי המט״ש מטעם המזמין.

הספר יוכן בשפה האנגלית ובשפה העברית.

3.6 **<u>אופני מדידה ותשלום</u>**

עבור הפיקוח **ע״י הקבלן** על התקנת הציוד והרצתו לא ישולם בנפרד, והמחיר ייחשב ככלול במחירים השונים בכתב הכמויות. המחיר יכלול את כל שירותי הפיקוח שינתנו על ידי נציגי הקבלן.

עבור הפיקוח ע״י **נציגי היצרן** ישולם לפי הסעיף בכתב הכמויות, ובהתאם להגדרת היחידה man visit בכתב הכמויות:

Payment for the checking of civil engineering drawings and the inspection and measurement of the civil engineering works by the **Supplier** shall be understood as included in the bid price for the supply of the equipment and no separate payment will be made for these services.

Payment for site visits by the **Manufacturer** to inspect the civil engineering works will be based on the pre-fixed unit prices entered by the Owner in the Bill of Quantities for “man-visits” by the Manufacturer. Site visits by the **Supplier** to inspect the civil engineering works shall be understood as included in the bid price for the supply of the equipment and no separate payment will be made for these services.

A man-visit by the **Manufacturer** shall be understood to mean the services of at least one person at the Site for three (3) working days, where each working day is defined as ten (10) hours long. The pre-fixed price per man-visit listed in the Bill of Quantities shall be understood to include the following costs: labor at the Site; labor for the time spent traveling to and from the Site, whether locally or abroad; travel (including airfare and costs by other means of travel); hotel; meals; specialized testing or other equipment needed for the purposes of the visit; and all other expenses connected to the visit to the Site. If the manufacturer decide to send more than one person, the unit price will not be changed.

עבור הכנת ספר תפעול ותחזוקה ועבור הדרכת עובדי המזמין, לא ישולם בנפרד ומחירם יהיה כלול במחיר אספקת הציוד.

תאגיד מי שמש בע"מ

מכרז מס' 4/24

מט"ש עמק האלה

תכנון, אספקת ממברנות וציוד נילווה, פיקוח על התקנתם, הרצה, שירות ואחריות של מערך הMBR

כרך ב' – חלק 3 – פרק 4 – מפרט טכני

תאגיד מי שמש

Abbreviations

ASL	Above sea level
CAPEX	Capital expenditure
CIP	Clean in place
DO	Dissolved oxygen
IBS	Schlegel consulting engineers
MBR	Membrane bioreactor
MF	Microfiltration
MLSS	Mixed liquor suspended solids
OPEX	Operational expenditure
PLC	Programmable logic controller
SCADA	Supervisory Control and Data Acquisition
TMP	Trans membrane pressure
TSS	Total suspended solids
UF	Ultrafiltration
WWTP	Wastewater treatment plant

1. General information

1.1 Location

Elevation: 269 – 272 m ASL

Ambient temperature: - 2 – 45 °C
Relative humidity: 5 – 100 %

1.2 Construction firm and planning office

Plant's Owner
Mei Shemesh

Planning the treatment trains
Schlegel Consulting Engineers
Guntherstraße 29
D-80639 München
Tel: +49/89/17902-0
Fax: +49/89/17902-225
www.ib-schlegel.de

1.3 Planned treatment concept

A new wastewater treatment plant that utilizes MBR technology must be constructed. MBR relies heavily on the pretreatment steps. Therefore, care will be taken when designing the pretreatment and biological treatment to meet MBR requirements. The supplier must work closely with the client to adjust design elements and achieve optimal results with their membranes.

The general concept is that the treatment plant is built with 4 parallel lines with the ability to take out 1 line at peak hourly flows without affecting the full capacity of the plant (n-1). Furthermore, the individual units of each line are interconnected, so it is possible to take one unit out of order without taking the entire line offline. For example, one MBR tank can be taken offline, but the flow from the attached biological line will be redirected to the three remaining MBR tanks and they must be able to handle the maximum load.
The wastewater treatment plant (including the membrane filtration) should have no down time at all. Any maintenance needed should be done on a one unit per line bases.

The planned treatment units are as follows:

Ponds:
The equalization pond will be used to limit the peak hourly flow to the plant to 3,333 m^3/h, even during Sabbath and other holidays.

There is also a disqualified effluent pond that can be used for emergencies when the plant's effluent quality cannot meet minimum criteria temporarily. The water stored in this pond will then have to be retreated in periods of low flow to the system.

A final effluent pond will also be used to buffer the effluent before being released for agricultural use.

Headworks:
The plant will be gravity fed with no pumps before the MBR Tanks. At the influent to the MBR tanks, influent pumps will push the MLSS into the MBR tanks (pump-to configuration)

Preliminary screening:
The Inlet will be strained through medium screening with a 12 mm bar spacing to protect downstream units from blockage and abrasion.

Sand and grease traps:
The grit chamber will be built as parallel rectangular tanks. The grit chamber will have the following main specifications:

- Minimum retention time: 5.1 minutes
- Aerated: yes
- Removal of 0.2-0.25 mm with an efficiency ≥95%

Primary clarifier:
Primary clarifier will also be built as rectangular basins. Using an HRT of 1.5 hours, the expected removal rates are:

- COD:35%
- VSS:50%
- TSS:60%
- TKN:10%
- TP:10%

Fine screening:
In order to protect the MBR system from sludging, a fine mesh screen will be installed before the biological tanks. The RAS from the MBR basin will also be partially recycled to the head of the fine screens as an extra measure to prevent long term sludging and preventing an accumulation of fibrous material in the MBR tanks.

Any MBR tanks drained will also be recycled to the head of the fine screens.

- Mesh pore size: 1 mm
- Partial RAS to screens: 1,500 - 2,000 m^3/d.
- Additional requirements to be specified by the supplier if applicable.

Biological reactors and MBR tanks:
The design of the biological tanks is heavily influenced by the design of the MBR tanks and will be optimized in a cooperative effort between the client and the supplier within the limits placed by the client and his representatives. For details on the guidelines for designing the biology as well as the MBR, see chapter 3.

Chlorine contact tanks:
As a final disinfection step, a rectangular chlorine contact tank with a contact time of 45 minutes and a residual chlorine concentration of 0.5 mg/l in the effluent of the contact tank is planned.

Sludge treatment:
The sludge will be thickened and sent to an anaerobic digester to produce better quality sludge and biogas. The sludge will then be dried with a centrifuge and disposed of with trucks.

2. General terms

At Emek Ha Ella, a new wastewater treatment plant (WWTP) is being constructed which will serve the valley region. The plant was approved by the Israeli authorities to utilize Membrane bioreactor (MBR) technology in order to provide water that is safe for irrigation.

The operator of the WWTP (referred to as **"client"** from hereon) will rate the system based on the criteria given in the evaluation criteria.

The supplier has to provide the client and his representatives with a complete offer according to the criteria set in this tender.

Within the tender the supplier must describe the measures taken to establish quality assurances and must share with the client as well as all other project partners, and in a timely manner, the plans and execution.

The supplier is required to perform the commissioning, startup, proof of function and training of the staff for the first 6 months from the date of receipt of confirmation of completion of the facility ("Delivery Confirmation").

During startup, in case that the agreed upon operational parameters, and especially the quality of the effluent (TSS) is not able to be established, then the supplier is obliged to operate and optimize the system, including replacing or addition of membranes or other components/ equipment or upgrading parts of the system or the entirety of the system, until the agreed upon effluent values are reached and held for at least 3 more months.

If the required and contractually guaranteed discharge values are not achieved 6 months after commissioning, the client reserves the right to terminate the contract. The client will then initiate alternative measures to achieve the required discharge values. The costs for these replacement measures will be passed on to the supplier.

The mechanical, electrical, and contractual service warranty period only begins after the customer´s approval of the completion of the facility and the commencement of its operation.

A design for the biological treatment and the separate MBR must be provided during tender to evaluate the complete system design. Nevertheless, the supplier is not responsible for the design of the biological treatment and may only provide suggestions. The ultimate design for the biological step must be designed and approved by the client and his representatives. The supplier will also specify the requirements for pretreatment required to guaranty nominal operation of the MBR (e.g., fat removal, fine screens...etc.). The supplier is not responsible for designing the pre-treatment steps past specifying these minimum requirements.

The winning bid will be selected based on the evaluation criteria document, provided it satisfies the requirements mentioned in this tender.

2.1 Terms and conditions

With the offer, the supplier must provide information about the technical knowledge, efficiency, and reliability. They should at minimum include:

- Provide on behalf of the manufacturer at least one internationally recognized certificate, or at least three comparable references for important claims made regarding the performance of the system (e.g. membrane lifetime, oxygen transfer efficiency, CIP requirements and frequency, maximum and design fluxes, MLSS and COD tolerances of the membranes, etc.)
- The size of the full-time workers employed by the supplier during the last 3 fiscal years. It must be at least 10 full time workers.
- The technical equipment available to the supplier for the execution of the service to be awarded.
- The technical staff designated for the service and supervision with name and years of professional experience.
- Proof of no outstanding legal proceedings against the supplier as a result of non-completed work for another client, either nationally or abroad.
- All supplied equipment shall be manufactured in facilities that are ISO 9001 certified or equivalent.
- The equipment should be directly warranted by the manufacturer with a signed confirmation.
- All supplied equipment shall comply at the minimum with the relevant standards in Israel or in the country where the manufacturer is registered.
- All equipment supplied must meet the standards defined in chapter 4, if applicable.
- The manufacturer for any equipment must be registered in one of the members of the Organization for Economic Cooperation and Development (OECD)
- The supplier shall be the main contact point and source of information for all supplied equipment, regardless of the manufacturer.
- The supplier shall use equipment manufactured by a well-known manufacturer in their field and who regularly manufactures the delivered items for the specific use case of municipal wastewater treatment of a similar or larger capacity.
- All provided items shall be original from the manufacturer (OEM parts).
- The supplier is responsible for the durability and successful operation of their system. No claims shall be accepted which blames local conditions at the plant for malfunctions or poor performance.
- The client shall bare no costs for the effort and manhours the supplier invests into preparing the tender or the contract, testing and shipping the equipment, supervising the installation, commissioning and startup, personnel training, preparing and submitting the required documentation, etc. Any such costs, including travel and testing equipment expenses must therefore be included in the CAPEX cost formula as part of the services rendered.
- The supplier is obliged to provide experienced qualified personnel for each inquiry, visit or supervision job, either provided directly from their team or the manufacturer. The client and his representative can ask for a replacement if they are not satisfied with the qualifications of the expert provided by the supplier.
- All site visits by the supplier or the manufacturer are to be understood as full day shifts (10 hours).
- The supplied submerged membranes must be from one of the following membrane manufacturers: Kubota, Veolia, Mitsubishi, Mann+Hummel (Microdyn Nadir), DuPont.

- The supplier is obliged to fill all applicable forms and appendices attached with this tender.

The offer must be made in the English language using the metric units.

The supplier must offer a complete description with a functional system. The level of detail should cover all operational parameters and quality assurance measures as well as specification of the employed technologies.

For detailed information regarding the scope of delivery, see chapters 4 and 6.

The supplier bares all costs related to the bidding process and the preparations and manpower associated with it. The client is not liable to any compensation, regardless of how the contract is awarded at the end.

2.2 Summary of outcome/agreed compensation

Below is a table regarding some of the Agreed compensation defined in the tender. The list below is not exhaustive and does not derogate from the relevant provisions in the contract.

Table 1: Summary of penalties.

Event	Outcome
Exceeding the defined time limits for e.g., providing requested information, providing design optimizations after the tender has been awarded	Financial compensations as specifiend in the contract
Exceeding the time limit for delivering the equipment to the client after the tender is awarded	compensations as specifiend in the contract. If delay exceeds 3 months, then contract may be terminated, and a new supplier is chosen for the missing equipment with the additional costs covered by the existing supplier.
Exceeding the time limit for delivering the documentation to the client after the tenderer was determined as the winner of the tender or after the tender is awarded	compensations as specifiend in the contract
Exceeding the time limit to correct the documentation	compensations as specifiend in the contract
Commissioning: Exceeding the defined two weeks for replacement of malfunctioning parts during the start-up period	The client may intervene and add additional equipment and measures to ensure a functioning system at the expense of the supplier.
Unsuccessful startup period (up till 6 months from commissioning)	The supplier must optimize the system and add additional equipment as necessary at no additional cost to the client.

Event	Outcome
Unsuccessful startup period (after 6 months from commissioning)	Startup period will be extended until the supplier achieves agreed upon values. The client may initiate alternative methods to ensure the quality of the effluent at the expense of the supplier.
System exceeds calculated operational costs in terms of energy demand or chemical use as defined by the supplier in the offer.	compensations as specifiend in the contract

3. Design and implementation

The wastewater characteristics and quantities have been estimated via conducting studies and based on experience by the client.

3.1 Effluent quality and operational guarantees

Authorities approved the plant to be built around the MBR technology, followed by chlorine-based disinfection.

The wastewater must be treated to meet the legal requirements for unlimited irrigation. Requirements for the effluent quality are given in Table **2**.

The biological system that the supplier designs in cooperation with the client for the MBR system must be able to achieve the effluent quality as stated in Table **2**, after the disinfection treatment.

Table 2: Required effluent quality.

Parameter	**Unit**	**Effluent quality**	
		Max of monthly average	**Max of a single sample**
BOD_5	mg/l	10	15
COD	mg/l	100	150
TSS	mg/l	10	15
$N\text{-}NH_4$	mg/l	10	15
TN	mg/l	25	35
TP	mg/l	5	7
Fecal coliform	Unit / 100 ml	10^3	50^2
pH		6,5 - 8,5	6,5 - 8,5
Residual chlorine	mg/l	1	

3.2 Conditions for system design

The plant will be equipped with coarse bar screens (12 mm bar spacing), followed by sand and grease traps, followed by primary sedimentation and finally followed by a fine screen mesh (1 mm mesh size) before the biological tanks with a water depth of 9 m. The water depth might be subject to change without additional compensation to the supplier. The supplier does not need to design those but must specify any special requirements regarding those units in order to ensure nominal operation of the entire MBR system as well as to provide the guaranty for the system. Any special requirements will then be introduced as a factor in the CAPEX and OPEX costs of the system by the client when evaluating the offers.

Table **3** shows the expected influent wastewater characteristics at the plant.

Table 3: Wastewater Constituents.

Parameter	**Unit**	**Amount in the WWTP Influent**	**Influent to the biological treatment, including primary treatment and backloads from side stream**
Inflow to WWTP (average daily flow)	m^3/d	40,000	41,200
Inflow to WWTP, start phase (average daily flow)	m^3/d	15,000	15,600
Max hourly flow (assume 4 hrs/d)	m^3/h	3,333	3,400
Water temperature	°C	18 - 28	18 - 28
BOD_5	mg/l	400	280
COD	mg/l	990	673
TSS	mg/l	385	216
TKN	mg/l	84	79
NH_4	mg/l	52	56,2
TP	mg/l	12	12,4
Alkalinity (as CaCO3)	mg/l	380	380

The supplier must also show the operational parameter for the starting phase of the plant, where the WWTP will receive a lowered influent amount of 15,000 m^3/d for an undefined period of time. Furthermore, the supplier must show the system parameters during the peak hourly flow and while one train is out of commission. The system must be able to adapt to these varying flow conditions.

The entire treatment up till the MBR tanks are designed to be flowing via gravity without pumps. Pumps will however be used to feed the MLSS from the biological reactors into the MBR tanks (pump-to configuration).

The supplier is not responsible for the design of the biological treatment. That will be designed by IBS on behalf of the client. However, since MBR technology is highly linked to the design of the biological treatment, the supplier is obliged to also submit their ideal design for the biological treatment as well as the design for the MBR following the criteria defined in this chapter. This design must be in line with the design proposed by IBS, and if there are contradictions then the supplier shall support IBS in adjusting IBS´s design accordingly during the tendering process. The supplier must check the final design and agree with it but ultimately the final design of the biology must be approved by IBS.

The 9 m deep biological basins are to be designed with multiple zones, first an anaerobic (de-oxygenation) zone, followed by an anoxic zone for denitrification, followed by an optionally aerated zone that can serve to either expand the aerobic or anoxic zones, based on temperature and effluent demands, this is then followed by an aerated zone for nitrification. Finally, the MBR basin is to be planned in a separate tank from the main biological treatment. The volume of the aerated MBR tank can count towards the aerobic zone when possible. This can only be done when the supplier provides references showing that this is typical for their system. The supplier is to

provide calculations for the oxygen demand of the CAS tanks in Nm^3/h. A schematic example for one line of the biological treatment is shown in Figure **1** below.

Key parameters of the supplier´s process design must be filled in Appendix 3.1 and returned in its Excel form as well as in printed form.

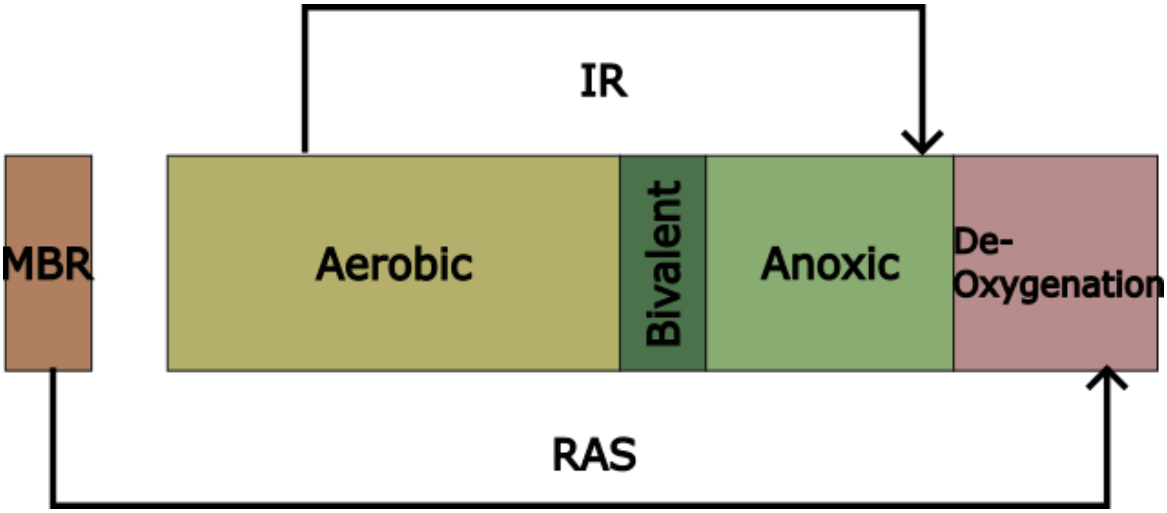


Figure 1. Schematic example for a multi-zonal biological treatment solution.

In order to design the biological treatment and MBR basin, the following criteria must be met (Table **4**).

Table 4: Design criteria

Parameter	**Unit**	**Amount**
Sludge loading rate	Kg BOD/kg MLSS	≤ 0.12
Sludge age (SRT) at 26°C	days	≥ 10 (not including the de-oxygenation zone)
Alpha factor (for CAS) for mechanical aeration following the planning concept		Depending on MLSS inside the tanks: • MLSS ≥ 10 g/L, Alpha factor must be ≤ 0,65 • MLSS >8-10 g/L, Alpha factor must be ≤ 0,7 • MLSS 7-8 g/L, Alpha factor must be ≤ 0.75
Alpha factor for MBR		Manufacturer dependent. Cannot exceed the values defined in the cell above. The supplier must provide certificates and/or references for the provided alpha value.
Minimum required oxygen conc. In CAS	mg/L	2
Specific standard oxygen transfer rate	g O_2 / (mN^3.m)	12.5
Average daily flux (gross)	%	≤ 50% of the membrane's peak hourly flux (gross) as defined by the manufacturer and not exceeding the nominal trans membrane pressure (TMP).
Temperature for average daily flux calculation	°C	16
Peak factor for carbon respiration		1.2
Peak factor for ammonium oxidation		2
Safety factor for nitrification		1.6
V_D/V_{AT}* (Winter-Summer)	%	28-36%
No. of lines for CAS tanks		4
No. of lines for MBR-tanks		4 to 8
Water depth in CAS	m	9
Water depth in the MBR tank	m	3 - 6
Design $MLSS_{CAS}$	g/L	7
Max $MLSS_{CAS}$ allowed	g/L	9
Max Turbidity in permeate	NTU	1
Max TSS in permeate	mg/l	2

*V_D/V_{AT}: refers to the volume of the denitrification zone to the volume of the CAS tank. The range is changeable by the variable zone which can be aerobic or anoxic depending on water temperature and treatment requirements.

Further requirements include:

- The use of flux enhancers such as polymers is prohibited.
- The use of chemicals during regular backpulsing / backwashing, is prohibited.
- Chemical cleaning schedule for maintenance cleaning needs to be defined in a table with frequency and amount and type of chemicals, to be integrated in the report.
- The amount of water and the frequency for backwashing / backpulsing need to be defined.
- Backwashing / backpulsing water must be added to the hydraulic load of the plant.
- Deep chemical cleaning operations must not exceed twice yearly.
- The supplier supplies all auxiliary equipment, including blowers for the crossflow aeration. Therefore, the supplier must define the energy usage expected.
- Any claim regarding aeration, chemical cleaning demands, oxygen transfer via crossflow aeration, as well as expected flux, must be proven by at least 3 references of comparable size and type of wastewater.
- In case of any change between submission of the tender and commissioning regarding any factors that influence the operational costs (e.g., calculated power and chemical demand) that lie in the responsibility of the supplier and cannot be justified by the optimization of the layout, the supplier shall be fined according to the fines defined in the legal document.

3.3 Redundancy concept

The design of the CAS tanks is made as 4 parallel and equal lines. The design of the MBR tanks should be made as 4 to 8 parallel and equal lines, where one line can be taken out of operation for at least 14 days without effecting the design capacity of the plant, hydraulic or otherwise, including peak hydraulic load of 3,400 m^3/h for 4 hours. The MBR basins should also be independently able to be shut down while the accompanying biological line continues to operate via connection to the other membrane basins, or vice versa.

Each MBR tank must be able to be backwashed and chemically cleaned individually and independent from each other.

All machinery, including but not limited to, pumps and blowers, must be designed as n+1.

The supplier must consider additional 15% reserve capacity in the MBR Tank. In case that the stated flow conditions cannot be achieved with the supplier´s design during the testing period, this reserve will be used to increase the capacity by installing more membranes on the supplier's cost, until the promised flow is reached. All auxiliary equipment must also be delivered with 15% more capacity as a reserve (blowers, aerators, chemical cleaning, etc.).

4. Scope of delivery

This functional tender describes in the following chapters, the guidelines for the required civil, mechanical and electrical parts of the system.

The supplier must comply with this list and deliver a detailed and complete plan of how they will perform the tender. This includes schematics and PID and a list of components as well as a calculation of CAPEX and OPEX.

All the submitted files must follow the provided attached forms when applicable.

All membrane modules and cassettes must be manufactured in ISO 9001 certified facilities and shall be all from a single manufacturer and identical type of model.

Every type of units shall also be supplied on the basis of one manufacturer and identical type of model.

All Items supplied must be new and from the manufacturer´s current product and standard line and must be tested for flawless functionality before shipping to the client. The supplier must hand in the certificates for shop testing and fault free parts and send it to the client both digitally and as hard copies. Only after the client approves these documents the shipping process can begin. If the client does not approve the documents, more rigorous testing must be performed free of charge by the supplier upon request from the client.

The shop testing shall include all supplied parts, including but not limited to: membrane modules, blowers, pumps, valves, control equipment, electrical equipment, piping, etc.. The supplier is also responsible for testing the software and interfaces with other systems and running a simulation to ensure that all parts are compatible with the conditions on site to ensure smooth operation with the rest of the plant.

The noise levels from any supplied equipment shall not exceed 75 dB from a distance of 1 m, regardless of load.

4.1 System boundary

- The boundary limit of the system included in this tender is shown as red lines in Appendix 3.2 as part of both the layout and the PID diagram.
- Flange joints are defined at the connection point of all pipes to be delivered.
- The boundary of the MBR tanks starts with and includes the sluice gates that control the influent to the MBR tanks,
- The boundary includes the MBR system and all its periphery, including chemical dosing and air blowers.
- The system ends at the pipe leaving the equalization/backwash tank (after 1 m) to the disinfection basin.
- The boundary for the blowers starts at the flange of the suction pipe to the blowers and ends at the flange after the electrical control valve after each blower.
- The boundary for the air pipe (air header) at the MBR tank to the pressure air pipe from the blowers is a connection flange 1 m from the MBR tank.

4.2 Materials

In general, the equipment delivered must satisfy the following minimum criteria:

- All supplied items must be fit for purpose and be of high quality and constructed using best engineering practices.
- All equipment and pipes that are in contact with wastewater or chemicals, shall be rated to withstand this without corrosion or damage.
- Exposed equipment outdoors shall be made to withstand abrasion from UV, heavy rain, wind and sandstorms which might intensify as a result of climate change.
- Membranes: all steel components of each membrane cassette shall be manufactured from stainless steel with a grade of at least Type 316/316L, or equivalent, or better. All non-steel components of the membranes must be resistant to UV and all non-steel components exposed to wastewater or chemicals must be resistant to those chemicals to at least the same degree as the membranes.
- Stainless steel Type 316/316L, or equivalent, or better should be used for any pipes, valves, and mechanical equipment surfaces in contact with wastewater.
- Steel and metal components must allow for corrosion and abrasion during the 20 years life of the equipment. Therefore, the corrosion tolerance layer shall not be less than 2 mm.
- Corrosion resistant steel or PVC should be used for surfaces in contact with corrosive mediums and chemicals.
- Heat and corrosion resistant materials should be used for the airpipes and manifolds.
- All equipment shall be able to withstand chemicals, temperatures and humidities beyond the expected conditions to be encountered during operation.
- Paint coatings according to DIN EN ISO 12944-5 and the color will be according to the client's wishes.

4.3 Civil works

4.3.1 During the tender process

The supplier does not design the civil works, nor are they responsible for the construction, instead they are liable for accurate and timely communication of the required space (also for periphery) and basin volumes and connection points for pipes resulting from their system design. The supplier shall design a preliminary layout, which will be communicated to Schlegel consulting engineers, who will then use the information to adjust the sizing of the aforementioned units and perform the civil constructions cost calculations.

The MBR will be connected to two separate buildings. The main operational building where the blowers can be placed (Building N in the attached preliminary layout), as well as a smaller building next to the membrane basis (Building R) where the permeate pumps as well as the chemical dosing station will be housed. Process air and chemicals should be transported in a single pressure pipe to the group of MBR tanks where they split up and will be connected to each of the membrane tanks.

The waste sludge pumps can be found in in the installation channel under the street in between the two groups of biological basins. The biological basins are to be fed from a unified feed source, divided equally via weirs.

4.3.2 After the tender is awarded:

The supplier is obliged to the following:

- Observe the requirements throughout the entire tender.
- Submit complete set of detailed documentation and design (More information in chapter 0).
- The supplier is obliged to communicate with Schlegel consulting engineers in a timely manner regarding the optimization of the layout in order to best suit their MBR system within the limits of what the client wishes and what is stated in this tender.
- The final schematic for civil engineering and installation will be approved by both the client as well as the supplier in writing.
- Provide timely assistance in the construction and installation process. More details regarding this in chapters 0 and 0.

4.4 Mechanical engineering

The supplier shall deliver the items and provide details of the entire MBR system, including all the required periphery for operation and maintenance. This includes permeate and chemical dosing pumps, blower for membrane aeration, including electrical control valves, sensors, Sluice gates for influent control to the MBR tanks, etc. The supplier should provide exact specification for the placement and installation of these parts. Any requirements for cranes to lift the membranes or additional basins for deep membrane cleaning operations must be stated. Cranes and separate membrane cleaning basins are not included in the scope of delivery but will be included in the tender evaluation.

The obligation to describe all equipment required excludes the systems and periphery for the biological wastewater treatment (biological reactor). The supplier can assume that this will be offered by another supplier for another part of the project.

Dry pumps are to be used for ease of access wherever applicable. The pumps must be equipped with sensors to prevent them from running dry and getting damaged. The pumps must have enough pressure and flow rate to achieve their named purpose.

Crossflow blowers and nozzles must also be specified so as to achieve both leap low and leap high operations.

All valves, pipes, including their individual diameter and length, as well as any flanches used must be specified by the supplier.

Optional peripheries are defined as equipment that is not required for regular operation and maintenance. Optional peripheries should be supplied separately in an appendix accompanying the offer.

The mechanical equipment must all be supplied from a unified manufacturer where applicable (e.g., membranes and cassettes from the same manufacturer).

4.4.1 Mechanical pre-treatment

The supplier must define any requirement for pre-treatment to protect the membranes, prolong their service lives, reduce the need for maintenance, and increase the filtration rates / filtration time.

This includes any special screening needs (e.g., 1 mm drum sieves, or special considerations for designing the grit chamber, fat skimmer or primary clarification tanks).

4.4.2 Membrane bioreactor (MBR)

The MBR modules are to be submerged in a separate tank with a **pump to configuration**. This means that the wastewater is pumped to the membrane tank and the RAS flows back to the biological reactors by gravity. The design of the modules should consider large flow fluctuations (starting phase, daily average and hourly maximum) that were defined in chapter 0.

The membranes can be either hollow fiber or flat sheet configuration, with submerged modules and an outside-in flow regime which is achieved either via permeate pumps or priming pumps and waterhead differential.

The modules and their periphery should be equipped with a sensor package required for monitoring the effluent quality, operation of the system, and protection of pumps and modules.
The chemical dosing for foam reduction, maintenance cleaning and deep cleaning as well as the backwash tank – if required - should be included in the detailed offer.

The membranes operation should be designed in such a way that the required flux is always available. The filtration and relaxing cycles, as well as the maintenance cleaning and deep cleaning operations and the pressure used for all operational phases should all be described in the report submitted as part of the offer. The membranes must never need to be removed from their tanks for backwashing, cleaning and deep cleaning operations.

The aforementioned operational parameters must all be proven by 3 references of comparable size and with at least 3 years operational time.

The membranes, their cassettes, connectors, pipes and peripheries where applicable, must be able to resist the chemicals that are suggested for use in chemical cleaning operations such as acids and bases as well as hypochlorite solutions. The membranes must also be rated for operation in an MBR setting with an MLSS concentration of ≥12 g/L. The membrane resistivity must be shown in the form of internationally recognized certificates upon request by the client or his representatives. Any requested certificates must then be sent digitally and as hard copies with no additional charges.

Each membrane cassette must be liftable and removable from the MBR tank individually or as pairs without draining the tank or interrupting operation. All necessary valves and lifting eyes to achieve this must already be part of the supplier’s offer.

The individual MBR basins should be able to be cleaned separately from each other. The blowers required for all lines will be seated in one operational building and must

share a common inlet as well as a common manifold supplying air to the membranes. The crossflow air demand to control fouling at the membranes as well as keep the MLSS in suspension will be designed by the supplier.

Cleaning and maintenance:
Chemical cleaning system must be included as part of the offer and must be designed on a n+1 basis for the pumps for each chemical to ensure uninterrupted operation. The chemical tanks must be encased with a concrete basin, double sleeved and equipped with leak detecting sensors and in accordance to the Israeli safety standards. The supplied package must be sufficient for cleaning and maintenance operation that is automated and be able to start on command and be connected to the plant's control system. The cleaning system in its entirety must be sized sufficiently to cover the need of the entire system plus future expansions (space left in the MBR tanks for reserve membranes).
The system should automatically perform checks and return to normal filtration mode after cleaning is performed without requiring intervention. Records of all cleaning procedures, including frequency, duration, flow rate, chemical usage, and concentration must be stored on the electronic logs and be accessible by the operator of the plant.

The system must include all pumps, tanks, pipes, valves, control elements, sensors etc., which are needed to perform maintenance cleaning of the system automatically and via button press and to perform deep cleaning via a button press.

Integrity testing:
The system must be monitored for breakthrough at all times, which would indicate damage to the integrity of the membranes. This is achieved by installing continuous online-turbidity monitoring for the effluent each membrane tank. Any increase over the nominal values assigned for turbidity shall trigger an audible and visual alarm for the operator. The turbidity meter shall be delivered from a reliable manufacturer and represent the manufacturer´s standard equipment for his membrane's operations.

Piping, fittings, and valves:
Supplier shall provide pipes, valves and fittings within the boundary limits of the MBR system as defined in appendix 3.2.

All pipes, fittings, and valves outdoors shall be manufactured from stainless steel Type 316/316L, or equivalent, or better and be compatible with each other in terms of material and diameter.

All air pipes shall be made of stainless-steel Type 316/316L, or equivalent, or better.

Indoor housed pipes must be manufactured with stainless-steel Type 316/316L, or equivalent, or better.

The supplied valves and actuators must provide the capability for operating the system in an electrically automated way.

Any piping support, hangers, flanges and fittings required must also be included in the offer.

Miscellaneous:
Anything necessary for operation and maintenance that was not explicitly mentioned so far, such as electrical components, diffusors, piping, valves, other fittings, cassette support structure, tank drain valves, membrane cleaning apparatus, backwash tanks, level monitoring and instrumentation must also be included to offer automation and full

functionality of the system, as part of the offer for the design boundary of the system as defined by appendix 3.2.

All supplied periphery, including pipes, valves and periphery must be able to apply at the maximum temperatures and pressures (positive and negative) which are expected for the system.

4.4.3 Biological tank

Schlegel consulting engineers is responsible for the design of the biological system on behalf of the client. However, the supplier is required to submit the ideal design of the biological tank for their system according to the parameters set in this tender. This is because each MBR system will require slightly different operational parameters and system design. This includes indicating the oxygen demand resulting from the MLSS and operational parameters selected by the supplier. The air demand is covered both by the aerated zone in the CAS reactors, as well as the MBR tank. After the design is submitted, it will be reviewed by the client and either the original design from Schlegel will be optimized to fit the system design suggested by the winning supplier, or the supplier must further optimize their design to meet the design parameters set by Schlegel consulting engineers. The decision regarding this rests solely with Schlegel consulting engineers and the client.

The supplier is not obliged to deliver a detailed design for the equipment used in the biological tanks. The supplier should only provide details sufficient for the purposes of modelling the treatment performance using the zones specified in Figure **1**, as per the design criteria defined in chapter 3.

4.4.4 Wastewater/permeate pumps

The supplier shall not be responsible for the WAS pumps. RAS pumps are not intended since the system is a pump to configuration.

The MBR feed pumps are not supplied as part of the tender.

The drainage pumps must be supplied as part of the offer if the manufacturer’s cleaning procedure requires it (e.g., deep cleaning).

The permeate must be collected via separate pipes, each collecting permeate from all modules in a single MBR tank. The manifolds will then be joined as one manifold that will then be connected to the centralized permeate pumps which will be sitting in the pumping station next to the MBR tanks.

Backwash pumps must be supplied where applicable, either as reversible permeate pumps, or a separate set of pumps.

Non-submersible permeate or priming pumps must be offered including all valves, check valves and a sensor package (level, flowmeter, pressure sensors) required for safe operation and switching of pumps for replacement or maintenance without interrupting the system. The pumps must be able to match the operational range from 1 line being in operation to all lines being in operation with 15% reserve capacity for future membrane modules. A single pump must be able to be regulated in a range of 60-100%.

All pumps must be properly dimensioned to offer the required flows and the required maximum pressure differentials, including loses in pipes and equipment.

This section outlines specifications for centrifugal pumps designed for all applications where dry pumps are used, including permeate and backwash pumps. The supplied Pumps must adhere to the following general requirements:

- Provision of all necessary components for operation including base plates, cables, guiding pipes, base elbows, couplings, guards, and more.
- Maximum noise level of the pumps of 75 dBA at a distance of one meter from the equipment
- Pressure measurements in the pressure lines immediately after all pumps
- Service factor of 1.15
- Compatibility for operation through a VFD unit.
- Stainless steel Type 316/316L, or equivalent, or better for all components that are in contact with liquids
- Paint coatings according to DIN EN ISO 12944-5

For all offered centrifugal pumps, the supplier must submit:

- The manufacturer's predicted performance curves for head, capacity, energy requirements, efficiency and NPSHR.
- Reference drawings for general dimensions, Certified copies of test logs and performance curves as specified within this Section.

Pumps must be from one of the following manufacturers:

- KSB
- Egger
- Xylem
- Sulzer
- Grundfos

4.4.5 Chemical dosing pumps

Each set of pumps will be specifically selected for the chemical it will handle. Pumps must be designed for continuous operation at the specified concentrations. All pumps will operate using frequency-controlled motors. The scope of delivery includes all pumps as complete units ready for connection and operation. The dosing pumps shall adhere to the manufacturer's standard design.
Electronic pumps will operate based on a 4 – 20 mA signal supplied from the system's control panel. Material for the pumps must be selected regarding the processed chemical and withstand any exposure related to it.

The following manufacturers can participate in the tender:

- Prominent
- Grundfos
- Sera

4.4.6 Blowers

In this section specifications for the blowers that provide the air for membrane aeration are given. Blowers should be designed in a way that a stand-by blower of the same size as the duty blowers, so that required air for the system's operation is available even when one of the duty blowers is offline. Blowers must be designed with a sound enclosure. The maximum noise level of the blowers must not exceed 75 dB(A) at a distance of 1 meter. Blowers must be designed using variable frequency drive (VFD) for operation. The blowers must be a turbo blower design to improve system's performance over time. The bearing will be air foil bearing or magnetic bearing with backup power for spinning down without damage to the bearing in case of power outages.

Crossflow blowers must be able to offer the maximum flow rates and pressure encountered at the MBR tank as well as leave room for reserve. The blowers' motors must also operate in an air-cooled fashion, and they must be able to operate in the expected ambient air temperature for the region.

The supplier must include all periphery necessary for smooth long-term operation for the blowers in the offer, including but not limited to air cooling system, electrical control valves and check valves as well as sensors to monitor air temperature, pressure and flow rate on both the suction and pressure sides as is standard for the type of blower provided. The blower systems must be able to match the operational range from 1 line being in operation to all lines being in operation with 15% reserve capacity for future membrane modules. The blowers must be able to satisfy the maximum hourly demand of the system.

The system must be designed as a n+1 reserve in case of faulty blowers. The blowers must be able to be regulated individually across their entire operational range and support both leap low and leap high operations if applicable. The blowers must be able to be maintained or replaced individually without interrupting the operation of the system.

The supplier shall not be concerned with supplying the blowers for the biological tanks, only the blowers to the MBR tanks for the purposes of crossflow aeration to clean the membranes are part of this tender.

All blowers must be equipped with motor speed control. Air flow measurement is mandatory for each blower group.
The maximum ambient temperature shall be 38°C, and maximum relative humidity is: 70 %. Elevation of the site is around 270 m ASL.

Every blower must be at minimum equipped with:

- Discharge check valves (Flapper Type)
- Air intake filter/silencer
- Discharge silencer
- Pressure relief Valve
- Inlet and discharge pressure gauges
- A blower butterfly isolation valve
- An acoustic sound enclosure for each blower as necessary
- Sensor package (inlet and outlet temperature, pressure and flowrate monitoring)

- PLC module to control and automate the operation of blowers.

The following manufacturers can participate in the tender:

- Sulzer
- HV-Turbo (Howden)
- Kaeser
- Invent
- Aerzen

4.4.7 Motors specifications

Standards

Motors supplied shall at a minimum meet the efficiency specifications of the USA EIS act of 2007.
Motors supplied shall comply with the latest revision of the NEMA MG1 standard, section 31.
Motors shall also comply with both the national electrical code as well as the latest standards from the Canadian standard association (CSA) where applicable.

Operational conditions

Motors supplied must be suitable for the following operational conditions:

- Frames 140-320: Ambient temperature from -20°C to +40°C @ 1.15 service factor.
- Frames ≥ 320: Ambient temperature from -40°C to +40°C @ 1.15 service factor.
- Altitudes up to 1000 m
- Must be suitable for installation under extreme conditions: elevated humidity, chemical and salt corrosion.
- Weather and dust proofing up to at least IP54 standards.
- Full voltage, across the line starting capability.
- Adjustable frequency driven motors meeting NEMA MG1 standard, section 31.

4.4.8 Caution signs:

All motors and rotating equipment drives shall be equipped with caution signs. The exact position of the signs will be decided by the client or his representatives later in the project.

The caution signs shall read "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME".

4.4.9 Supplier's obligations during the tender process

According to the information provided in this tender, the supplier shall:

- Observe the requirements throughout entire tender, especially chapter 0.
- Provide detailed recommendations regarding mechanical and primary treatment requirements.
- Provide a complete set of documentation and schematics (see chapter 0)

- Upon request from the client or his representatives, the supplier must provide comparable additional references, regarding claims that were not covered under chapter 0, within 3 weeks.
- Provide a design for the MBR and the biological treatment according to the parameters set forth in this tender.
- Upon request from the client or his representatives, the supplier must make adjustments and optimizations to their design within 15 days of receiving the feedback.
- The supplier shall provide the complete information behind their calculations and designs in an examinable manner and provide answers to any questions by the client or his representatives within 1 week of receiving the inquiries.

4.4.10 Supplier's obligations after the tender is awarded

The supplier is obliged at minimum to the following, at no additional costs to the client:

- The supplier must deliver all equipment to the client's storage facility within the time period defined in the previous chapter
- If the delivery delay exceeds 3 months, then the client may choose to select another supplier to purchase the missing items from and the additional costs shall be endured by the supplier.
- Observe the requirements throughout entire tender, especially chapter 0.
- Provide a complete set of detailed documentations and schematics (see chapter 0)
- Hold bi-weekly meetings with the client and his representatives to discuss and optimize the system and its design.
- Respond within 2 weeks to any information requests or design changes by the client or his representatives.
- Provide new equipment that is the current line of production from the manufacturer and produced at the manufacturer's certified facilities with their warranty.
- Provide equipment of the same type and from the same manufacturer for each type of units
- Ensure that the manufacturer will test all equipment in the shop and provide shop testing certificates and reports before shipping.
- The client must be informed 6 weeks prior to shop testing, so that they can attend and supervise the tests if so desired.
- All equipment must be pre-assembled before shipping according to standard best practices, so as not to require excessive effort and time on-site for assembly.
- Ship all the equipment in a safe and secure manner to the client at the designated place where the items will be stored (defined by the client). All boxes shall be clearly numbered, labeled, and documented in an inventory manifest to be handed to the client.
- The storage site shall be an open-air facility. Communicate in a timely manner with the client regarding any storage requirements for the items and the maintenance demand as specified by the manufacturer during storage (e.g. moving mechanical parts, using conservation solutions, etc.). The supplier shall be responsible for any damaged items during the storage period and must replace them at no additional cost to the client.
- Provide qualified personnel that will perform said maintenance tasks during the storage period.
- Inspect the deliveries for missing items as well as shipping damage immediately upon arrival at the storage site. Any missing or damaged equipment shall be replaced at no additional costs to the client. The client shall be informed 2 weeks in advance so that they can be present if desired. The supplier shall then sign a

certificate showing the equipment has been fully and safely delivered with no damage or missing parts.
- During installation, commissioning and training, the supplier shall aid in the process as specified in chapter 5.

4.5 Electrical engineering and control

4.5.1 Electrical inputs

The electrical supply will be delivered by the electrical engineer from the side of the WWTP in the form of low and medium voltage electrical boxes in the desired locations around the plant.
The supplier is required to share the electrical demand and the number and type of electrical connections and switches for the MBR system and all its periphery which is required for operation, maintenance, and inspection of the system.

The electrical components must all be compatible with IEC 439-1 and 2 / EN 60439 Parts 1 and 2.

The electrical components to be supplied must support the automated operation of the system.

4.5.2 Electrical panel specification for external suppliers

Panels supplied by an external party (equipment suppliers) for machinery and/or equipment, such as blowers, mechanical screeners, odor treatment, transitional cabinets, chemical processing equipment, etc., will meet the requirements of Israeli Standard IS61439 and the special specification for electrical and communication works and the requirements of the designer and the commissioner alongside compliance with the fire detection and extinguishing regulations. This includes embedding the typical single-line diagram requirements as an integral part of the board price without any addition. The panel must also meet the requirements of the Water Authority's water security division requirements in all cyber matters and following the general communication scheme, all as an embedded part of the unit price without any addition.

- Approval of all internal and external electrical components will meet the requirements of the specification and will be identical to the components of the electrical and communication panels of the other components of the facility equipment approved by the engineering team.
- The structure and type of board, its dimensions and all its details will be approved only by the electrical engineering team and subject to his guidelines and the requirements of the special specification, and no claim of "machine board is an integral part of it even if the machine comes from a manufacturer located beyond the borders of the country of Israel" The board will be built of an reinforced polyester structure with a double internal door on which all the equipment will be installed, in case of outdoor installation a shed will be installed as a roofing for the panels, all as part of the price of the machine without any additional monetary from the unit price specified in the above .
- Each machine will be supplied with a board separately and no common board will be approved for more than a single machine assembly even if the assembly serves the same machine.

- The manufacturer and model of the programmable logic controller (PLC) that manages and controls the operation of the machine and which is supplied together and as an integral part of the panel and all accompanying control designs such as expansion cards, suppliers, connectors and adapters, etc. will be of the type approved only by the engineering team in writing and such as the equipment approved in all facilities for reasons of uniformity and standardization. which includes sockets connecting to the fiber optic or communication cable up to the switch that is managed as required by the general communication scheme.
- The programmable logic controller (PLC) must be able to communicate with the main control and monitoring system in the main operational building of the WWTP and/or customer's main SCADA system.
- All equipment supplied by the contractor/machine supplier will meet the requirements and regulations of running inside an extremely high degree of corrosiveness environment such as sewage pumping stations, marine atmosphere and will also follow explosive atmosphere regulations if required by the safety consultant and as an integral part of the work framework .
- All electronic cards of PLC, soft starter, VFD, etc. will be coated with dedicated varnish for a lifespan adapted to the harsh installation conditions. Busbars will be coated with tin .
- The panel of the machine will include, among other things :
- Main circuit breaker with thermal and magnetic protections regardless of the feed up circuit breaker, the equipment supplier will provide and install a main circuit breaker on the machine board supplied with it that includes all the required protections as part of the unit price .
- Terminal block with LED indicator light for dry contacts for transmitting indicators for all actions and malfunctions of the machine operation regime. (All circuit breakers, contactors, relays, etc.).
- An industrial type of managed network switch of at least 5 FE RG45 ports and 2 SFP (1G LC or SE GBIC included) ports for connecting the entire contents of the internal board such as touch screen, controller, energy transducers, etc. with the general communication system of the other SCADA facilities fiber optic or alternatively Cat7.
- A trip coil for all pump breakers and motors over 5HP and service breakers larger than 32A and for the main circuit breaker in addition to the upstream circuit breaker which will be connected to fire detection and extinguishing control as well as to the output relays of the local controller, which includes emergency battery buttons as appears in the principal scheme.
- Installation of auxiliary contacts for all circuit breakers, contactors, and relays for reporting an operation / malfunction sign .
- All inputs and outputs are relay type only. A controller with non-REALY outputs will not be approved and will be wired to clamps with an LED sign at the exit and input from the machine board.
- All cables entering/exiting panels, cabinets, junction box will be via pipe glands (PG) only.
- The command circuits will be fed only after isolating-transformer. The supply of which will be suitable for all the equipment used.
- Phase disarray and voltage fault relays for three-phase and/or single-phase monitoring will be installed.
- All surge arresters will be of CLASS B+C.
- Torque protection for small motors appears in the principal scheme .
- At least 8A external power supply with MCB (AC or DC types) protection for all field equipment feeds such as buoys, valves, etc.
- Marking lamps for operation/fault sign for each engine in addition to the manual / automatic power switch circuit breaker detail.
- No electrical motor output exceeding 5.5 hp will be approved without a digital soft starter and/or VFD as needed in the process flowchart.
- The command detail of the pumps and electrical motors will be adapted to the general detail of the station equipment prepared by the engineering team with adjustments to the process flow of the machine.

- All regulators/starters will be connected by communication to the local switch and from there to the general communication system.
- The manufacturer will prepare a register table for transferring all the information that is conducted on the local controller and will enable full connection with the SCADA array and writing and reading the various operating values .
- A machine book will be sent along with post-execution plans and working and maintenance instructions in three copies .
- The supplier shall submit a position plan of all the equipment it intends to use, trenches, stands for the installation of equipment, cable ladder and metal parts, subject to the list of equipment approved by the planner and which appears in the special specification and in the estimate for approval prior to the implementation of the facility and subject to the instructions of the electrical planner.
- All command accessories shall be original, sealed, for external installation at least IP67 sealing level according to the design and characterization of the designer. It is hereby emphasized that no command accessories that differ from those specified in the plans will be approved, even if they are proven to be equivalent.
- The location of the installation and placement of the machine panel will be approved by the chief designer and following the packaging of the machine and the requirements of the structure in which it is installed .
- Everything needed above and required by the designer is an integral part of the price of the machine and will not charge any added price for it.

All electrical panels of external suppliers and in general installed in explosive space will meet the requirements of the standard and regulations and will be of the type of explosion-proof panels and the supplier will meet all the requirements of the general specifications and regulations and will provide approved equipment bearing a standard mark for the designation of explosive zones.

4.5.3 Compliance with standards

The equipment presented in this technical specification is in accordance with the requirements of the latest relevant published recommendations of the International Electro-technical Commission (IEC) and the Israeli IS correspondent standards. All relevant aspects: tests, etc., IEC's recommendations, executed according to the latest published issue of official or otherwise approved standards of Manufacturer's country.

General Standards

- IEC 60255: Electrical relays
- IEC 60038: IEC Standard voltages
- IEC 60068: Environmental testing
- IEC 60664: Insulation coordination for equipment within low-voltage systems

Ce-marking standards

- EN 50081-2 Emissivity (Industry)
- EN 50082-2 Immunity (Industry)

Detailed standards

As shown in the Table **5** below:

Table 5. Detailed standards list.

Standard	Details
IEC-60255	Part 1: Tests on Cables and their Accessories Part 2: General and Construction Requirements
IEC 60947	Low Voltage Switchgear and Control gear
IEC 61439	Low-Voltage Switchgear and Control gear Assemblies
IEC 62271-1	High-Voltage Switchgear and Control gear – Part 1: Common Specifications
IEC 60502-1	Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV) – Part 1: Cables for Rated Voltages of 1 kV (Um = 1.2 kV) and 3 kV (Um = 3.6 kV)
IEC 60502-2	Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV) – Part 2: Cables for Rated Voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
IEC 60502-4	Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
IEC 60034-1	Rotating Electrical Machines – Part 1: Rating and Performance
IEC 62305	Protection against lightning
IEC-60870-2-1	Power supply and electromagnetic compatibility
IEC 61000-6	Electromagnetic computability
IEC 60068	Vibration and shock withstand
IEC-60225 PT22-1	High frequency disturbance test class III
IEC-60225 PT22-2	Electrostatic discharge test (ESD) Class 4
IEC-60225 PT22-2	Electrostatic discharge test (ESD) Class 3
IEC-60225 PT22-3	Immunity to radiated electromagnetic energy
IEEE C37.90.2	Immunity to radio frequency interference (RFI)
ENV 61000-4-3	Radiated Immunity from digital communications
IEC 61000-4-9,10	Power Frequency Magnetic Field Immunity
ENV 50204	Radiated Immunity from Digital Radio Telephones
89/336/EEC	EMC compliance

4.5.4 Automation and control

The programmable logic controller (PLC) must be able to communicate with the main control and monitoring system in the main operational building. The requirements for this are as follows:
The PLC system must be able to automate the regular operation and maintenance of the MBR system (filtration, relaxation periods, backwashing, backpulsing, CIP, etc.) depending on the manufacturers recommended guidelines for the system.

The system may be provided as a blackbox, or the operator is allowed to change the parameters of operation as desired.

In any case the system must be able to interface with the main control system in the main operational building. The main control system (both main SCADA and PLC/HMI hardware) will be of the leading manufacturers Schneider Electric, Siemens or ABB only.

The interface must allow for real time monitoring and status reporting of the system, as well as reporting of any alarms that may be active at the time. The interface must also allow the controlling of any parameters (if applicable) and processes.

The utilized software and its interface with the main control system must be well documented, explained and full in its scope in order to provide full operation and maintenance of the system. The software utilized must be the full version with all the functions required to provide uninterrupted operation to the plant as well as all maintenance and cleaning operations.
The documentation must also contain text as well as graphical description of all processes (filtration and backwash / relaxation cycles, recommended CIP intervals, recommended deep cleaning interval, etc.).

The monitoring and control system to be offered includes field instrumentation, control panels, PLC as well as any necessary hardware and software for interfacing with the system via the operator as well as for interfacing with the main controller of the plant.

Periphery such as sensors to monitor the performance of the MBR, electrical equipment, control and interface and software packages which are necessary for the proper operation and maintenance of the system according to the manufacturer's standard operation, must be included in the offer.

The monitoring and control systems must be able to interface with the supplied sensors, for example, to show and record the pressures and flowrates in the system. The control systems must allow for automated operation and cleaning of the system with no interference from the plant's operators. Only deep cleaning schedules should require intervention from the operator to start at the press of a button. The system must display warnings and reminders for the recommended deep cleaning schedule on the screen.

4.5.5 Analysis and sampling

The quality of effluent analysis is to be made with sensors from consistent manufacturers for compatibility reasons. The signal is to be transferred to the main controller via the typical 4-20 mA. There must be a screen at the location that displays the monitored values.

4.5.6 Project documentation of PID and electrotechnics

All delivered electrical and control components must be fully documented in a descriptive, as well as in a PID – Schematic, and equipment and consumer lists.

There should also be complete documentation of any required interfaces with other systems.

4.5.7 Supplier's obligations during the tender process

In the offer resulting from this tender, the supplier must:

- Observe the requirements throughout entire tender, especially chapter 0.
- Provide a complete set of documentation and schematics (see chapter 0)
- Upon request from the client or his representatives, the supplier must provide comparable references within 2 weeks.
- Upon request from the client or his representatives, the supplier must make adjustments and optimizations to their design within 15 days of receiving the feedback.
- The supplier shall provide the complete information behind their calculations and designs in an examinable manner and provide answers to any questions by the client or his representatives within 1 week of receiving the inquiries.
- Provide a binding statement regarding the time between order and shipment of the items.

4.5.8 Supplier's obligations after the tender is awarded

The supplier is obliged at minimum to the following at no additional costs to the client:

- The supplier must deliver all equipment to the client's storage facility within the time period defined in the previous chapter
- If the delivery delay exceeds 3 months, then the client may choose to select another supplier to purchase the missing items from and the additional costs shall be endured by the supplier.
- Observe the requirements throughout entire tender, especially chapter 0.
- Provide a complete set of detailed documentations and schematics (see chapter 0)
- Hold bi-weekly meetings with the client and his representatives to discuss and optimize the system and its design.
- Submit a detailed control and automation concept to the client.
- Respond within 2 weeks to any information requests or design changes by the client or his representatives.
- Provide all the equipment and software needed to control and automate the operation and maintenance of the system. The interface and software shall be compatible with the plant's other PLC and SCADA systems. Those shall be specified with the client and his representatives at a later stage.
- Provide new equipment that is the manufacturer´s current line of production produced at the manufacturer's certified facilities with their warranty.
- Provide equipment of the same type and from the same manufacturer for each type of units
- Ensure that the manufacturer will test all equipment in the shop and provide shop testing certificates and reports before shipping.
- The client must be informed 6 weeks prior to shop testing, so that they can attend and supervise the tests if so desired.
- All equipment must be pre-assembled before shipping according to standard best practices, so as not to require excessive effort and time on-site for assembly.
- Ship all the equipment in a safe and secure manner to the client at the designated place where the items will be stored (defined by the client). All boxes shall be clearly numbered, labeled and documented in an inventory manifest to be handed to the client.
- The storage site shall be open air facility. Communicate in a timely manner with the client regarding any storage requirements for the items and the maintenance

demand as specified by the manufacturer during storage. The supplier shall be responsible for any damaged items during the storage period and must replace them at no additional cost to the client.
- Provide qualified personnel that will perform said maintenance tasks during the storage period.
- Inspect the deliveries for missing items as well as shipping damage immediately upon arrival at the storage site. Any missing or damaged equipment shall be replaced at no additional costs to the client. The client shall be informed 2 weeks in advance so that they can be present if desired. The supplier shall then sign a certificate showing the equipment has been fully and safely delivered with no damage or missing parts.
- During installation, commissioning and training, the supplier shall aid in the process as specified in chapter 5.

4.6 Spare parts

The supplier must provide a comprehensive list of recommended spare parts and their prices for operation of the system for the first two years of operation as part of the offer. This list will then become part of the awarded contract. Any claims regarding service life of components are subject to proof upon request from the client or his representatives. The proof can be via an internationally recognized certificate or a reference of comparable size and type that is in operation since at least 5 years. The proof is to be submitted both digitally and as a hard copy without any additional costs to the client.

The recommended spare parts list must provide a balance between the following considerations:

- It must allow the plant to operate smoothly without unnecessary interruptions.
- It must especially consider critical components that are subject to fail and may have long delivery times.
- It must consider the issue of storage shelf-life and deterioration, as well as storage space required.

The recommended spare parts list must be filled according to the categories defined in the instructions provided. The client and their representative will then evaluate the list and make a final list of spares to include in the final contract.

Necessary wear and tear items that are needed for the first 2 years of operation must be included as an appendix; this will not be part of the evaluation criteria.

The spare parts list is a part of the cost calculations and will also serves as a reference for the client for the contract stage. Therefore, all spare parts must be stated there, be it long term replacement parts, or daily wear parts, even the ones already included in the BOQ.

The supplier must also provide enough maintenance material for the entire commissioning and function testing period (6 months). These costs as well as the other similar costs can be added in the BOQ under the CAPEX category, Services, provided in the contract.

As specified with the main equipment supply, the spare parts and materials must be ensured to be free of malfunction and damage before shipping and must be controlled upon arrival at the designated storage facility of the client. Any special storage requirements and shelf life must be communicated to the client in advance.

4.7 Material and other costs

The supplier shall provide, at no additional costs to the client, one set of any special tools required for the operation and maintenance of the system. The tools must be of very high quality hard wearing durable materials and shall be delivered in heavy duty toolboxes with locks and multiple keys.

5. Service to be rendered

The supplier is obliged to assist in and be available for feedback during the construction of the plant. The documentation for the plant must be presented in full at most 6 weeks before commissioning starts.

The supplier is then obliged to perform commissioning of the MBR and then take part in the startup phase as well as the proof of function phase.

The operational costs for required material and chemicals except energy and fresh water are covered by the supplier during commissioning and proof of function. This includes required spare parts and maintenance materials. All these costs should be already included in the offer (BOQ).

5.1 Installation

The installation shall be performed by external contractors. However, the supplier is responsible for the correct installation of the system they delivered. This includes training the installation teams and supervising their work at all times during the installation phase. The supplier shall be available for technical support on the phone 24/7 during this period and shall make provisions for an expert to be on site as often as needed but at least once per week, as requested by the client and his representatives.

The supplier shall correct any mistakes in the installation process until they are satisfied that the installation is done according to the manufacturer's recommendations. The supplier shall then provide a written certificate that the installation was performed in accordance with the manufacturer's recommendations.

The supplier shall supervise the unpacking of the equipment and their installation. Once again everything must be inspected for damage and any corrosion or rust inflicted material shall be promptly replaced by the supplier at no additional costs to the client. The supplier shall be held responsible for any damage that occurs during the unpacking and installation process and shall replace missing or damaged parts without any additional costs to the client.

5.2 Commissioning

The supplier is obliged to supervise and actively take part in the commissioning. Therefore, the physical presence of the responsible technical staff named in chapter 0 must be guaranteed during this phase.

Since the WWTP is to be constructed from different parties that are interdependent on each other, the supplier is required to communicate with all other parties and the client in a timely manner in order to achieve a successful commissioning of the plant as a whole.

The commissioning phase for the MBR system must be done in three steps. These are minimum test parameters. If the recommended standard test protocols of the manufacturer call for stricter criteria, or includes parameters that are not mentioned here, then those shall be used instead. The standard testing methodology of the manufacturer is to be submitted as part of the documentation, at least 6 weeks prior to the start of commissioning:

Functionality check without medium
The supplier ensures the conformity of the delivered system with the specs specified in the tender as well as checks for any discrepancy which might cause problems during operation. This phase includes investigations if the provided electrical and PLC interfaces are working as specified, and that the automation software is working nominally and interfacing in a stable manner with the main control system of the plant.

This phase also includes the vacuum testing of all membranes and piping to ensure that at least 150% of the maximum expected operational pressure is safely withstood.

Functionality check with medium
The supplier checks the system with a medium other than wastewater (e.g., clean process water) to check for any errors or out of spec parts that don't deliver the correct performance. Process automation must also be checked in this phase.

This includes a demonstration by the supplier to the client that the automation and PLC systems works, the alarms and fail safes and simulated power failures and emergency shutdowns shall all be tested. All pumps and blowers must be tested to be performing according to their rated specs in this phase. The system must demonstrate the maximum rated design flux and TMP. The filtration / relaxation cycles and backwashing / backpulsing without chemicals will also be demonstrated in this step.

MBR tanks shall be tested one at a time. The clean water test is performed until all tests are passed and held for at least 2 weeks of continuous operation.
Functionality check with Wastewater
The supplier checks the system with wastewater to check for any errors or out of spec parts that do not deliver the correct hydraulic performance. The test will be performed with the defined hourly maximum flow (chapter 3).

The tests shall include the filtration / relaxation cycles and backwashing / backpulsing cycles as well any necessary CIP cycles. The wastewater test should achieve at least 1 month of stable operation without malfunctions.

In general, the functionality check should at minimum test the following functions:

- Test all electrical connections and control system, including emergency stops, restarts, alarms, and automation.
- Test all pump´s and blower´s performance (pressure and flowrate as well as operational range).
- Test the system for leaks and faults.
- Test the bubble point for membranes.
- Test the flux and TMP of the membranes under wastewater condition.
- Test the backwashing and chemical cleaning system, both in manual and automated modes.
- Test switching between the different MBR basins to simulate various flow conditions.
- Test air scour system
- Test switching power sources from normal to emergency and back again.
- Testing all systems and functions and their interfaces with other systems.
- Complying with any additional requirements the client or his representatives might have for testing.

If at any time the system suffers from a malfunction or fails to meet the design specifications, then the supplier is obliged to repair or replace the faulty equipment immediately at no additional costs to the client, until the problem has been resolved.

Failure to do so within 2 weeks gives the client the right to intervene and add additional equipment and measures to ensure a functioning system at the expense of the supplier.

The supplier must also provide on-line monitoring and remote assistance during commissioning and proof of function periods.

Successful commissioning must be documented for each of the three steps. The following points should be considered at minimum:

- The type of test performed and on what part of the system.
- Date and duration.
- Participants.
- Results of the investigation.
- Individual list of errors encountered and how they were solved.
- Proof of instruction for the plant's personnel (testimony of the plant operator or an attendance list must be included).

The documentation is to be presented for approval by the client, in the form of a protocol after each successful completion of a step.

5.3 Startup and proof of function

After successful commissioning of the system, the supplier is required to perform a startup and proof of function testing period of the system, which is a period of 6 months where the system is to be tested and verified to ensure the operational parameters as well as effluent quality are being held. The entire process must be thoroughly documented.

During the first 3 months startup period, the supplier is to optimize the functionality of the system. Clear and timely communication with the client and other parties is required, as the systems are interdependent. At least two visits per week from the supplier's technical staff (24 visits in total) must be guaranteed for this first period.

After the optimization phase is finished, and full operation and a steady state of the biological system are achieved, then the next 3 months will be considered as normal operation and serves as a proof of function test for the system where the supplier shows that the system performs up the parameters and the design submitted by the supplier during the tendering and contracting processes. The optimization phase is finished only with the approval of the client.

The proof of function testing will be in two parts that run in parallel: the first part regards functionality and shows that the system is performing as designed, and without malfunctions. The second part regards the performance of the system and will be evaluated in the form of performance testing client or their representatives. The protocol for performance testing is shown in chapter 0. The client reserves the right to perform their own tests to confirm the results of the supplier.
This proof of function period can only begin if both the client and the supplier agree in writing, that the biological system is functioning in a stable manner and sufficient capacity, so that at least one line can be tested at maximum flow conditions. Then the testing period must begin immediately.

Visits by the supplier's technical staff for the proof of function are to be performed as often as necessary, but at least two visits per week be guaranteed.

Since the plant is not expected to reach the full 40,000 m^3/d capacity within the first 6 months, the proof of function testing period will be carried out on one line at a time if necessary. The flows tested will be the minimum, average, and peak flows.

The startup and proof of function periods must include at least 10 chemical maintenance cleaning operations and at least one chemical deep cleaning operation (if applicable to the system).

If the design parameters cannot be met, or there are operational malfunctions within this period, then the testing phase is extended until the supplier achieves the agreed upon values. Alternatively, the client reserves the right to cancel the contract after the first 6 months if the proof of function is not successful. The client can then engage in alternative measures to achieve the required quality. These additional costs will be carried by the supplier.

The supplier shall document all test results, events, alarms, and errors during the entire testing period and submit them to the client at the end of the testing period. The client then has to respond within 2 weeks, either approving the results and, thereby ending the testing period, or demanding improvement if one or more parameters do not satisfy the agreed upon criteria set forth in this tender.

The following points are, among others, important during the proof of function testing period:

- Normalized design & maximum net and gross fluxes as well as their associated normalized TMP will be tested to be in accordance with the calculations in the offer within 24 hours.
- Cleaning frequency, chemical amounts, air demand, and energy demand of the system will be evaluated and shall meet the calculations of the offer. All calculations shall be based on normalized temperature.
- As part of the performance testing, effluent quality in the permeate in terms of TSS and turbidity shall not exceed what is defined in this document for more than 5% within 24 hours.
- Check the working order for all electrical and control systems including PLC, SCADA and interfaces.
- Operational malfunction is defined as any system errors (electrical, electronical or mechanical), that cause an unscheduled downtime, or require intervention of the operator to restart the system or re-establish normal operation.
- Any interruption due to external factors outside of the supplier’s control shall mean a pause on the testing. Only after the reason for the interruption is solved, testing shall continue.
- Interruptions which are outside the supplier’s control and last more than 3 months shall mean a successful end to the proof of function period unless there were obvious deficiencies in the MBR system and its peripheries. If such deficiencies were established and reported, then the supplier is obliged to fix those deficiencies despite the interruption to the proof of function testing.
- Any interruption occurring in the part of the system which is under the control of the supplier shall be immediately fixed or replaced by the supplier at no additional cost to the client. After the reason for the interruption is solved, the proof of function period is restarted for an additional 3 months if the client deems it necessary.
- The supplier shall supervise and directly be responsible for the operation of the plant during the testing period. The staff for operations shall be provided by the client and be guided and supervised by the supplier, both via remote technical support and via in person visits when required.

- The supplier must appoint a main contact person and their replacement in case of vacation or sick leave, for the entire duration of the proof of function testing.
- The supplier shall make detailed records of system parameters, system events, alarms, errors, and other relevant information. These are to be handed to the client on weekly basis for review and approval.
- The client shall be responsible for supervising the plant and testing the effluent quality as part of the performance testing. The client shall keep a shared log of effluent quality with the supplier.
- The supplier shall hold weekly meetings with the client when any irregularities or issues arise with the plant. Otherwise, monthly meetings with status report are to be held.
- Other than providing the staff for operation, the client bares no additional costs related to the personnel provided by the supplier or any other costs related to the supplier.
- The tests end when all documentation regarding testing protocols and results are submitted to the client and these has been signed and approved by the client.
- The supplier shall be responsible for supplying any specialized equipment required for performance testing.

5.3.1 Performance testing protocol

This chapter provides the performance testing protocol used as part of the proof of function testing. The performance testing is to ensure that the effluent quality parameters are being met.
The test will be conducted both via the in-line sensors (e.g., turbidity and DO) as well as via grab and 24 hours composite samples. The analytical work shall be performed by the client and his representatives. The supplier can also supervise the tests if they so wish. The supplier shall also closely supervise and advise the client's staff who will be responsible of operating the system during this time. The supplier, manufacturer and client shall all have full access to the system during this period.

The performance testing conditions are subject to the same general conditions as the proof of function test defined in chapter 0, including starting and pausing conditions.

All lines shall be tested. However, the flows during this test are not expected to reach full capacity. Therefore, through a combination of using the flow equalization ponds and testing one line at a time, the average daily and peak hourly flows shall be tested as defined in Table **4**. The peak hourly flows shall be tested on at least 1 month, for 4 hours per day out of the entire 3 months testing period. If during the 3 months, the flows reaching the plant do not allow this kind of maximum flow testing, then the highest number of maximum flow hours shall be tested.

The performance test shall be concerned with the parameters directly under the influence of the supplier, namely Turbidity and total suspended solids (TSS) as defined in Table **4**. However, since MBR operation and design is directly linked to the operation of biology and since the MBR supplier and manufacturer will take active part in optimizing the biological design during the tendering process, other operational parameters and effluent values must be actively adjusted in order to meet the effluent criteria defined in Table **2** as well. The supplier is required to work closely with the client's staff to achieve those limits. The supplier shall perform these optimizations as part of their contractual obligations at no additional costs to the client.

In the event of exceeding an operational limit for the membrane (e.g., excess fat, oil and grease (FOG) amount entering the biology, testing must halt, and the membranes

shall be operated in a manner that prevents them from becoming damaged. This shall continue until the adverse conditions are reversed.

Analytical techniques

- Turbidity meters shall be placed by the supplier on each MBR tank as well as the effluent of the system.
- Grab and composite samples are performed by the client and his representatives.
- The analytical techniques used during the test shall be standardized analytical methods supported by ISO or other comparable international standards.

Table 6: Sampling points.

No.	Sampling location	Sample type
1	Influent to biology	Grab & 24 hr. composite
2	Effluent de-oxygenation zone	In-line & grab
3	Effluent anoxic zone	Grab
4	Influent to MBR tanks	Grab
5	Permeate MBR tanks	In-Line & grab & 24 hr. composite
6	RAS line	Grab
7	Side stream (centrate)	Grab

Table 7: Sampling parameters and frequency of testing.

Sampling point / Analytical parameter	1 influent	2 de-oxygenation	3 anoxic	4 influent MBR	5 permeate	6 RAS	7 centrate
TSS	3 / week	3 / week	3 / week	daily	daily	3 / week	3 / week
Turbidity					In-line		
VSS	1 / week			3 / week	1 / week		1 / week
BOD_5	2 / week				daily		
NH_3-N	3 / week				daily		3 / week
NO_3-N					3 / week		
NO_2-N					3 / week		
TKN	3 / week				3 / week		3 / week
TN					3 / week		
TP	2 / week				2 / week		3 / week
PO_4-P	2 / week				2 / week		
DO		In-line	In-line	daily	In-line	daily	
SOUR				1 / week			
pH	In-line			daily	In-line		
FOG	1 / week			daily			
Water Temperature	In-line			In-line	In-line		
Alkalinity	3 / week				daily		
Total hardness	1 / week				1 / week		

cTOC				daily	daily		
TTF				daily	daily	1 / week	
Sieve test				3 / week			
SVI				3 / week		3 / week	
MLSS				3 / week		3 / week	

The sampling frequency for 24 hours composite samples is one sample each 8 hours using either manual or auto sampling.

5.4 Post commissioning service contract

Requirements for the provision of post-commissioning services are specified as an appendix in the agreement.

6. Documentation for submission

All of the documentation to be submitted either during the offer or during the contract period, must be submitted electronically as well as in hard copies to the client or his representatives.

6.1 During the offer

During the offering process, the supplier is obliged to provide, amongst other items if requested by the client or his representatives, the following:

- Include optimizations to the system if required within 15 days
- Preliminary design report containing the biology and MBR design as well as all related specifications for the MBR and biology (MLSS, air and energy demand, RAS ratios…etc.). The report may not exceed 30 pages in length.
- Complete technical data such as PID diagrams and functional description of the system and its interaction with the SCADA of the plant.
- Automation concept (5 pages maximum).
- Maintenance concept (5 pages maximum).
- Specifications and data sheets for all parts suggested in the offer.
- The energy demand calculations must include average energy consumption.
- Provide schematics for the location of the power demand of the system so that the electrical contractors can provide enough electrical panels at the areas where they are needed.
- List of spare parts.
- Detailed specification of any mechanical pre-treatment requirements necessary to maintain the performance of the membrane (drum sieve size, special demands for primary clarification and grit and oil chambers)
- Layout optimization based on the suggested layout in appendix 3.2 in order to fit the specific MBR demand of the manufacturer. This should show the size and locations of the MBR tanks, any suggested adjustments to the biological tanks, air, permeate, RAS, WAS and drainage pipes, as well as chemical cleaning and any other required parts for a functioning system.
- Detailed layout showing the MBR modules and air scouring system (including 15% reserve) as well as all peripheral equipment necessary for the complete functioning and maintenance of the system (blowers, pumps, chemical dosing, electrical devices, valves, sensors etc.). the layout should show the suggested location and size requirements based on the layout provided in appendix 3.2.
- The layout must also indicate spatial requirements for maintenance, for the membrane modules and the periphery.
- Complete breakdown of the investment costs with individual pricing using the CAPEX form provided (BOQ).
- Complete breakdown of operational costs using the energy and chemical consumption forms provided.
- Provide all certificates and references for claims made as requested in this tender, or when requested by the client or his representatives.
- If the provided references for the design flux cannot be obtained from a climate with similar temperatures as Emek Ha Ella, then the design flux and TMP will be standardized based on the temperature correction factor (TCF) using equations 2.11 through 2.16 from the EPA's Membrane filtration guidance manual (section attached in appendix 3.3). The supplier must specify and provide certificates for the maximum flux at 20°C and this will then be converted to the correct design flux at 18°C. No offer will be accepted without providing at least an internationally recognized certificates for maximum flux at 20°C.

- Internationally recognized certificates for rustproofing, corrosion and chemical resistance, heat resistance, UV resistance, abrasion resistance, and any other durability claims for all equipment and periphery.

Any adjustments, resubmissions or additional submissions have to be fulfilled by the supplier within 15 working days.

6.2 After the tender is awarded

During the planning and execution phase, regular meetings are to be held as often as necessary but at least every 2 weeks with the client and his representatives.

6.2.1 Installation and construction-aid documentation

The supplier must submit carefully prepared installation and assembly drawings for the entire system, which must comply with the following guidelines or contain the following details:

- Complete bill of materials for the delivered items. Labeled clearly with details about the weight, size, and number of each item, as well as safety warnings when applicable.
- The supplier is to create installation and assembly drawings for all system parts of his scope of work in a suitable scale (M = 1: 50 or larger). The drawing must detail the elevations, the spatial relationship between the different equipment and structural elements as well as their connecting points, supports, anchors and interfaces.
- The main dimensions and (work) space requirements when dismantling important parts for repairs or maintenance should be clearly specified.
- Weight and load information as well as indication of the center of gravity as well as dry and wet weights.
- Pipe layout shall consider pipe length, connectors, orientation, pressure losses, water hammer effects and other static and dynamic effects.
- The pipe layout shall show the details for all valves, flanges, sensors, and actuators in the system. It shall also have provisions for ease of access and maintenance work and replacement of pipes and parts, PID diagrams and I/O lists as well as other information needed for installation.
- Storage and handling requirements based on manufacturer’s best practices.
- The materials and equipment are to be accompanied by detailed literature and specifications from the manufacturer.
- Noise level information.
- Safety information for the installation.
- Detailed installation guides for the equipment directly from the manufacturers.
- Certificate of correct installation by the installation teams must be signed by the supplier to indicate their satisfaction with the installation procedure.
- The energy demand calculations must include minimum, average and maximum energy consumption.

The construction plans are adjusted by the client and his representatives to suit the mechanical and electrical components proposed.

The drawings must be submitted to the client or his representatives for inspection in good time so that any necessary corrections can still be taken into account by the supplier. The drawings are to be produced in their external form in accordance with the

standards and specifications of the client (e.g., with project-related information from the customer - pre-standardized plan heads or similar).

The drawing review should proceed as follows to ensure everything is documented and performed correctly:

1. Submission of drawing by the supplier (6-fold and digital as pdf and dwg)
2. Checking the drawings and other documents by the client and his representatives
3. Coordination with the supplier
4. Incorporation of the corrections, if necessary
5. Final template for approval (6-fold)
6. Final approval by the client and his representatives

6.2.2 Technical documentation

The supplier is required to deliver complete technical documentation (6-fold and in pdf and dwg format) for any parts delivered from his side. This includes mechanical and electronical, equipment.

This documentation should contain at minimum the following details:

- Complete operating manuals and maintenance manuals with suggested best practices and cleaning schedules.
- The manuals can be disqualified by the client or his representatives if they don't satisfy their needs and a request to rework parts of the manuals or their entirety can be made at the discretion of the client, which the supplier must comply with.
- Complete process control and automation documentation. This includes operational parameters, controlling the system and relationship to other systems, monitoring the system and interface with the main control unit of the WWTP.
- Representation of the relationships in program flow chart plans and as a detailed PID scheme showing all the elements, pipes, valves, sensors, motors, control elements, etc.
- Provide the General-Station-Description files (GSD) for the device´s interface.
- Provide detailed wiring and control diagrams and schematics showing interaction and wiring between components. This should include functional description and automation concept.

The abovementioned documents shall be delivered by the supplier to the client or his representatives within at most 30 days after the approval of shop drawing and installation documents. Failure to do so entitles the client to fine the supplier 500 USD/day for each delayed day past 90 days.

The drawings must be submitted to the client or his representatives for inspection in good time so that any necessary corrections can still be taken into account by the supplier. The drawings are to be produced in their external form in accordance with the standards and specifications of the customer (e.g., with project-related information from the customer - pre-standardized plan heads or similar).
The drawing review should proceed as follows to ensure everything is documented correctly:

1. Submission of drawing by the supplier (6-fold and digital in pdf and dwg format)
2. Checking the drawings and other documents by the client and his representatives

3. Coordination with the supplier
4. Incorporation of the corrections, if necessary
5. Final template for approval (6-fold)
6. Final approval by the client and his representatives

6.2.3 Inventory documentation

The supplier is to provide the client and his representatives with complete documentation of all provided systems. This includes at a minimum:

- Complete bill of equipment and materials with their individual prices
- List of spare parts provided (for two years) and their prices.
- List of all provided piping and fittings used.
- A list of all required materials, fresh water and energy for daily operation and maintenance.
- A list of all sensors and devices used, with their specifications and power consumption.
- A list of all signals used for the control system and their interface type.
- A list of all motors used along with their specs, performance curves, insulation rating, noise levels, electrical requirements during startup and operation as well as schematic drawings.
- Datasheets for all the items in the previous points.
- Commissioning reports, including manufacturers testing protocols.
- Training reports.
- Startup and proof of function reports.
- All required certificates and references defined in this document or requested by the client.
- Control, automation, and Interfacing reports.
- CAD and DWG files must be provided for the client and his representatives.

7. Warranties, and maintenance

The supplier must offer details to the guaranty of each of the parts delivered with the system (e.g., membranes, pumps, blowers, sensors, etc.). This includes any extended warranty options or service agreements.

The guaranties to be delivered must include:

- Mechanical guaranty: replacement of faulty or damaged modules resulting from manufacturing defects or improper design due to false or optimistic parameters in the offer (e.g., too high design flux, TMP, or too long cleaning cycles).
- The warranty must be a full warranty. The warranty period can be different between the membranes and the periphery.
- The full warranty shall be at least 2 years for the entire package supplied. The full warranty for the membranes themselves should be at least 7 years.
- Replacement of any faulty membrane element or other periphery of the systems (including supplied blowers, pumps, and control elements, among others) will need to be fully replaced free of charge during the full warranty period.
- A written guaranty that the client has the right to order membranes of the same type and quantity but the newest version within 10 years for the expansion to stage B of the plant based on the offered price, considering price adjustments.

8. Costs

The costs for the offer are to be calculated submitted in full as appendices to the offer, both for CAPEX and OPEX

The supplier must also use the provided spare parts form to share a list of spare parts as well as their prices.

There will also be forms for energy and chemical consumption that must be filled and returned in their original forms.

The CAPEX calculations must be submitted in an appendix as part of the tender and must include, but not be limited to:

- Costs of the supplied items.
- Volume of the MBR tanks for estimating the civil engineering costs, this is only for the evaluation process.
- Service contract costs
- Chemicals, operational and maintenance costs for the commissioning (except energy and water), startup and proof of function periods (as defined in chapter 5) must be included in the CAPEX form as a onetime payment.
- Visits to the site during installation, commissioning, startup and proof of function testing as defined in this tender.

The OPEX calculations to be submitted as a separate appendix and should include, but not be limited to:

- Calculated energy costs during normal operation
- Operational material (water, chemicals, oil and grease, etc.)
- Critical spares (wear and tear items and consumables) that needs regular replacing within a year to maintain operation of the MBR system. This also includes consumables like lubricants and grease. as well as in the spare parts form.

The price calculations are performed separately for each item. No sum calculations for systems will be accepted. For example, the membranes are to be calculated separately from the pumps and blowers etc.

9. Definitions

Below are the definitions for the terms used throughout this tender document:

Average daily flow:
The average flow rate received during a 24-hour period based on expected annual data.

Average daily flux:
Is the flux being sustained during a 24-hour period.

Backpulsing:
A non-chemical rinsing of the membranes using the permeate water. It is a temporary reversal of the flow direction of the permeate pumps in order to remove contamination from the surface of the membrane. it utilizes smaller pulses of permeate water instead of a continuous stream like backwashing.

Backwashing:
A non-chemical rinsing of the membranes using the permeate water. It is a temporary reversal of the flow direction of the permeate pumps in order to remove contamination from the surface of the membrane. It uses a continuous stream of permeate water for a defined period of time. These are performed periodically in an automatic manner. For example, every few minutes. Membranes typically either employ backwashing or backpulsing, depending on the type of membranes.

CAPEX:
Capital expenditure refers to the one-time capital investment costs encountered when establishing the plant.

Cassette:
A collection of membrane modules that comprise a self-contained unit of membranes from the manufacturer. The membranes in a cassette are supported by a frame and contain anchoring points, common permeate manifold as well as cross flow aeration aggregates for cleaning. The cassette should also contain lifting hooks to facilitate maintenance.

CIP or deep cleaning:
Clean in place refers to a restorative cleaning method using more concentrated chemicals and longer contact times. This can take place a few times a year and aims to fully restore the flux performance of the membranes.

Client:
The client is the legal entity entering into the contract with the supplier or the manufacturer.

Critical spares:
Wear and tear items as well as consumable materials like oils and grease. These are the kind of items expected to be needed on a regular basis (required to be replaced at least once a year).

DO:
Dissolved oxygen concentration in water and wastewater, typically measured in mg/l.

Gross flux:
It is the flux of the membrane without considering the relaxation / backwashing / backpulsing operations. It is measured in $L/m^2/h$ or LMH in short form.

Maintenance cleaning:
It is shorter chemical cleaning that takes place once every few days to once every few weeks. This can be automated or be performed manually and aims to partially restore the flux performance of the membranes.

Maximum hourly flow:
The maximum peak flow encountered during any 1 hour.

Maximum hourly flux:
Is the maximum hourly flux encountered during any 1 hour.

MBR:
Membrane bioreactor is a technology combining conventional biological treatment with ultrafiltration or microfiltration submerged membranes. The membranes replace the secondary clarifier in typical biological treatment plants. The membranes serve to separate the suspended solids from the final effluent (permeate).

Membrane tank (MBR Tank):
The MBR tank is the tank where the MBR cassettes are submerged in MLSS. The tanks contain the manifolds for the cassettes as well as air connections / diffusors for the crossflow aeration being supplied to the cassettes.

MLSS:
Mixed liquor suspended solids refer to the mixture of suspended solids with wastewater and the activated biomass. It is typically measured in g/l.

Net flux:
It is the flux of the membrane that considers the relaxation / backwashing / backpulsing operations. It is measured in $L/m^2/h$ or LMH in short form.

OPEX:
Operational expenditure costs refer to the reoccurring costs that must be incurred during operation.

Permeate:
It is the clean product water being drawn under vacuum through the membrane. The vacuum must be able to overcome the TMP as well as any additional hydraulic losses in the system.

PLC:
Programmable logic controller. It is a complete system that contains a controller and power modules and allows for communication and controlling of the various systems PLC is assigned to.

Relaxation period:
It is a period where the permeate pumps are stopped for the cassette and only the crossflow aeration is kept on. No chemicals are used during this period. It serves to remove contaminants attached to the surface of the membranes. It is usually automated and takes place periodically (ex. every few minutes).

SCADA:
Supervisory Control and Data Acquisition is a computer-based system for the controlling and monitoring of systems and processes in real time.

Supplier:

Supplier refers to the legal entity that is an authorized dealer of the manufacturer. The supplier is responsible for submitting the proposals and facilitating communication or directly representing the manufacturer during the signing of the contract as well as the fulfillment of contractual obligations.

TMP:
Trans membrane pressure is the pressure loss through the membrane boundary.

Treatment lines/trains:
A treatment line is a part of a parallel system of lines that comprise the entire treatment step. For example, there are 4 lines of treatment planned at Emek Ha Ella, that can be operated either in parallel or individually when the others are offline.

TSS:
Total suspended solids. Refers to the solids suspended in a liquid or wastewater.

10. Appendices and attachments

The following attachments are part of this section:

Appendix 3.1 - Process design parameters form
Appendix 3.2 - General layout & PID with boundary of tender
Appendix 3.3 - EPA's Membrane filtration guidance manual excerpt
Appendix 3.4 - Equipment specifications

Appendix 3.1

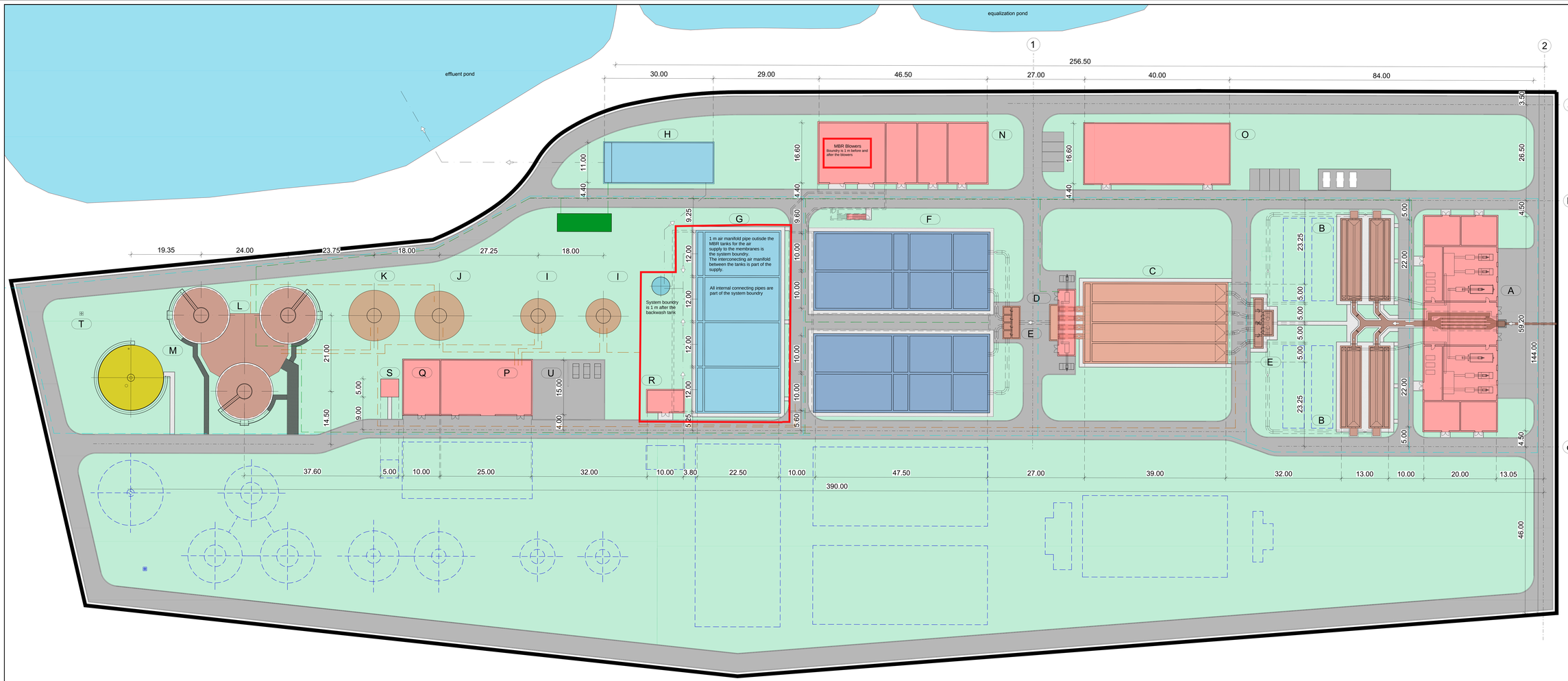
Process design parameters form

Appendix 3.1 - process design parameters form

Parameter	Unit	Min	Average	Max	Notes
MBR Design					
No. Of tanks	#	4	4	4	
Individual MBR tank depth	m				
Individual MBR tank width	m				
Individual MBR tank length	m				
Individual MBR tank volume	m^3				
Water level in MBR tanks	m				
No. Of Membrane modules per tank	#				
Membrane surface area per tank	m^2				
Average daily flux	LMH				
Maximum monthly flux	LMH				
Maximum daily flux	LMH				
Maximum hourly flux	LMH				
Design net flux	LMH				
Design gross flux	LMH				
Retrun activated sludge	% of influent				
Retrun activated sludge	m^3/h				
Waste activated sludge	m^3/h				
MLSS in MBR tanks	g/L				
Disolved oxygen concentraton in MBR tanks	mg/L				
Air demand for scouring at standard conditions	Nm^3/h				
Air demand for scouring at operational conditions	m^3/h				
Scouring areation Standard oxygen transfer rate (SOTR)	kg/h				Must be proven via a refernce
Scouring areation Specific standard oxgen transfer rate (SSOTR)	g O_2 / (m_N^3 * m)				Must be proven via a refernce
areation depth for scouring	m				
Type of bubbles					Course/fine
Interval between backwashing	min				
Interval between pauses	min				
Chemical maintance cleaning frequency	#/week				
Deep cleaning frequency	#/year				
CAS Design					
Volume of biological reactors	m^3				
Volume of de-oxygination zone (anaerobic)	m^3				
Volume of anoxic zone	m^3				
Volume of bivalent zone (aerobic/anoxic)	m^3				
volume of aerobic zone	m^3				
Water level depth	m	9	9	9	
Depth of areation	m	8.8	8.8	8.8	
Dissolved oxygen conc. In aerobic zone	mg/L	2	2	2	
MLSS in CAS	g/L				
Sludge retention time (SRT)	days				
Hydraulich retention time (HRT)	hours				
Waste activated sludge (WAS)	kg/d				
Oxygen demand in biology	kg/h				
Oxygen provided via MBR scouring	kg/h				Must be proven via a refernce
air demand in biology	Nm^3/h				
air demand in biology considering MBR scouring areation uptake	Nm^3/h				Must be proven via a refernce
Peak factor for carbon respiration		1.2	1.2	1.2	
Peak factor for ammonium oxidation		2	2	2	
Safety factor		1.6	1.6	1.6	

Appendix 3.2

General layout & PID with boundary of tender



Explanation Buildings

- A Coarse screening
- B Grit and grease chambers
- C Primary clarifier
- D Fine screening
- E Distribution shaft
- F Activated sludge basins
- G MBR basins
- H Disinfection basin
- I 2 WAS storage
- J Digested sludge storage
- K PS-Static thickener
- L Anaerobic digesters and digester control building
- M Gas storage
- N Operational building / blowers
- O Control and visitors building
- P Sludge thickening and drying
- Q Dewatered sludge silo
- R Pumping station entry
- S Gas drying
- T Gas flare
- U Sludge storage place

Service water
Drinking water
Sludge water

Rev.	Comment	Date	Name

Date	Kind	Nr	Subject	Drawing No.
14.09.2023	Layout	0000	1000	1201

Revision 0

Mei Shemesh Ltd.
Construction WWTP Emek Ha Ela

Subject: WWTP Emek Ha Ela

Design Phase: Stage B - General Planning

Kind of Plan: Top View

Scale 1:250
Format 1940x841
Date 14.09.2023
Drawn Schmieder
Checked Bonas

Engineer: SCHLEGEL Consulting Engineers, 88639 Wurndi, Germany (+49 (0) 17 90 3 0

Client: **Mei Shemesh Ltd.**
5 Yigal Alon
Tel Aviv Sheheun
Israel

Date 14.09.2023
Signed

A3x1/2

EQ Pond

Blower station grit/fat chamber

Chemicals filling station

FeCl3 dosing station

FeCl3

Blower station CAS

Blower station MBR

Disqualified effluent pond

Hypochlorite

HCL

Note: Chemicals used may vary depending on manufacturer's cleaning protocols.

Final effluent pond

Chlorination station

HOCL

Disqualified effluent bypass

Chlorination bypass

MBR emergency bypass

To EQ-Pond

Influent

Debris trap

Coarse screening
4 x 12 mm

Grit chamber / oil skimming
4 x 95 m3

Primary clarification
4 x 630 m3

Fine screening
4 x 1 mm

CAS
Anaerobic 4 x 855 m3
Anoxic 4 x 900 m3
Vario 4 x 270 m3
Aerobic 4 x 1.710 m3

MBR influent pumping

MBR Tanks
4 x 400 m3

MBR effluent/backwash tank

Chlorination Basin
1.250 m3

Solid waste

PS Pumping station

Partial RAS pumping
to the fine screens

RAS

Side stream

Skimmed oil

WAS Pumping station

Polymer

WAS storage overflow

WAS storage

Thickened WAS storage

PS thickner/storage

Thickeners

Mesophellic digesters

Biogas storage

Biogas blowers

To gas treatment and CHP

Flare

Optional: partial ferminted PS recycling to WAS storage
Reduces struvite formation in MAD

Digesters in a Separate PID

Digested sludge storage

Dewatered sludge silo

Dewatering

Note: Design, equipment, no. of MBR tanks and tank volumes are used as an example. They might be adjusted based on the manufacturer's recommendations after the tender has been awarded. Sensors and control equipment inside the boundry are not shown.

Legend

- Wastewater
- Sludge
- Chemicals
- Air
- Biogas
- Solid waste/grease
- Control signal
- The MBR supplier's system boundry for the tender

Project-No.: 2360.10		Customer: Mei Shmesh	
Project: Israel - Emek Ha Ella	Ecologic Consulting Engineers	Order number:	
Plant's overview P&ID		Draw. no. engineer:	
DIN A0		Draw. no. customer:	
	Date 15.01.2024	Unit: mA10	
	Name Dr.-Ing. M. Al-Azzawi	Origin:	Location:
	Checked	Replacement for:	Sheet: 001
Ind. Change Date Name	Standard	Replaced by:	Of: 1

Appendix 3.3

EPA's Membrane filtration guidance manual excerpt

If values for viscosity are known, the polynomial expression for viscosity as a function of temperature in Equation 2.10 may be simplified to a temperature correction factor (TCF). For a MF, UF, or MCF process, the TCF is defined as the ratio of the viscosity at temperature T to the viscosity at 20 °C, as shown in Equation 2.11:

$$TCF = \frac{\mu_T}{\mu_{20}} \qquad \text{Equation 2.11}$$

Where:
- TCF = temperature correction factor (dimensionless)
- μ_T = viscosity of water at temperature T (cp)
- μ_{20} = viscosity of water at 20 °C (cp)

Note that the term TCF is often used generically to refer to any type of correction factor used to adjust a parameter for temperature. Thus, the specific equation for the TCF may vary depending on the parameter to which it is applied. For example, in the context of membrane filtration, the TCF applied to reference MF, UF, and MCF flux to a standard temperature, as defined in Equation 2.11, is different than that applied to NF and RO flux to a standard temperature, as shown in Equation 2.19. Thus, it is important to always consider the context in which the term TCF is used.

Because the TCF is a dimensionless ratio, the values for viscosity can be expressed in any convenient and consistent units. Thus, the temperature-normalized flux can be expressed in simplified as terms, as shown in Equation 2.12:

$$J_{20} = J_T \bullet TCF \qquad \text{Equation 2.12}$$

Where:
- J_{20} = normalized flux at 20 °C (gfd)
- J_T = actual flux at temperature T (gfd)
- TCF = temperature correction factor (dimensionless)

Generally, in order to identify changes in productivity (as measured by flux) that are specifically attributable to membrane fouling, it is desirable to normalize the flux for pressure as well as temperature, as shown in Equation 2.13. Note that the temperature- and pressure-normalized flux is often referred to as the specific flux.

$$M_{20} = \frac{J_{20}}{TMP}$$ Equation 2.13

Where:
M_{20} = temperature- and pressure-normalized flux (gfd/psi)
J_{20} = normalized flux at 20 °C (gfd)
TMP = transmembrane pressure (psi)

The effect of temperature on a MF, UF, or MCF system can also be expressed in terms of a temperature-corrected TMP value. An expression for such a term can be derived by starting with a modified form of Equation 2.7, as shown below in Equation 2.14:

$$J \bullet R_t = \frac{TMP}{\mu}$$ Equation 2.14

Where:
J = flux (gfd)
R_t = total membrane resistance (psi/gfd-cp)
TMP = transmembrane pressure (psi)
μ = viscosity of water (cp)

For constant flux and membrane resistance, equating two expressions of Equation 2.14 illustrate the relationship between two pairs of TMP and viscosity data at different temperatures, as shown in Equation 2.15:

$$\left(\frac{TMP}{\mu}\right)_1 = J \bullet R_t = \left(\frac{TMP}{\mu}\right)_2$$ Equation 2.15

Where:
TMP = transmembrane pressure (psi)
μ = viscosity of water (cp)
J = flux (gfd)
R_t = total membrane resistance (psi/gfd-cp)

Rearranging Equation 2.15 and assigning a reference temperature of 20 °C yields an expression for the TMP at 20 °C as a function of any given TMP data point and the ratio of the water viscosity at 20 °C to that at the given data point, as shown in Equation 2.16:

$$TMP_{20} = TMP_T \bullet \left(\frac{\mu_{20}}{\mu_T} \right)$$ Equation 2.16

Where:
- TMP_{20} = transmembrane pressure at 20 °C (psi)
- TMP_T = transmembrane pressure at temperature T (psi)
- μ_{20} = viscosity of water at 20 °C (cp)
- μ_T = viscosity of water at temperature T (cp)

Equation 2.16 allows for the normalization of TMP data to 20 °C, or alternatively stated, the value of the TMP that would have been observed at 20 °C for the same flux and degree of fouling. By adjusting all the TMP data to the same reference temperature, any observed increase in TMP is known to be attributable to fouling or other phenomena that impact membrane resistance (such as compaction), assuming operation at constant flux.

2.4.3 NF and RO Processes

As with the microporous MF, UF, and MCF membranes, the driving force for the transport of water across a semi-permeable membrane – such as that utilized by NF and RO processes – is a pressure gradient across the membrane. However, because NF and RO processes reject dissolved salts, the resulting osmotic pressure gradient, which acts against the transport of water from the feed to the filtrate side of the membrane, must also be taken into account. Typically, the osmotic pressure gradient is approximated from the concentration of TDS on the feed and filtrate sides of the membrane. The corrected driving force across semi-permeable membrane is termed the net driving pressure (NDP) and can be calculated using Equation 2.17 (AWWA 1999):

$$NDP = \left[\left(\frac{P_f + P_c}{2} \right) - \left(P_p \right) \right] - \left[\left\{ \left(\frac{TDS_f + TDS_c}{2} \right) - TDS_p \right\} \bullet 0.01 \frac{psi}{mg/L} \right]$$

Equation 2.17

Where:
- NDP = net driving pressure (psi)
- P_f = feed pressure (psi)
- P_c = concentrate pressure (psi)
- P_p = filtrate pressure (i.e., backpressure) (psi)
- TDS_f = feed TDS concentration (mg/L)
- TDS_c = concentrate TDS concentration (mg/L)
- TDS_p = filtrate TDS concentration (mg/L)

Appendix 3.4

Equipment specifications

Equipment list specifications	**Units**	
Membranes		
Design parameters		
Required fine screen size (pre-treatment)	mm	
Design MLSS in the CAS reactors	g/L	
Design MLSS in the seperate MBR tanks	g/L	
Return activated sludge in relation to inflow to CAS	%	
Average Return activated sludge	m^3/d	
Average WAS flow	m^3/d	
General Information		
Manufacturer	-	
Type of membrane	-	
Membrane material	-	
Membrane pore size	µm	
Average gross daily flux	LMH	
Average net daily flux	LMH	
Maximum gross daily flux	LMH	
Maximum net daily flux	LMH	
Peak gross hourly flux	LMH	
Peak net hourly flux	LMH	
Weight per cassette	kg	
Design of MBR tanks		
Membrane surface area per module	m^2	
Number of modules per cassette		
Membrane surface area per cassette	m^2	
Total membrane surface area	m^2	
Number of lines of cassettes per MBR tank		
Number of rows of cassettes per MBR tank		
Number of membrane cassettes per MBR tank		
Number of membrane cassettes in total		
Number of MBR tanks		
Volume of each MBR tank	m^3	
Depth of each MBR tank	m	
Width of each MBR tank	m	
Length of each MBR tank	m	
Freebord of MBR tanks	m	
Number of reserve cassette placeholders per MBR tank		

Equipment list specifications	**Units**		
Crossflow specifications			
Design parameters			
Required crossflow air @ 0°C and 101 kpa per cassete	Nm^3/h		
Required crossflow air @ 0°C and 101 kpa per tank	Nm^3/h		
Required crossflow air @ 0°C and 101 kpa total	Nm^3/h		
Oxygen delivered for COD removal by crossflow aeration	kg O_2/h		
Number of blowers			
General Information			
Manufacturer of blower			
Place of manufacturing of blower			
Blower model			
Maximum inflow air temperature for air cooling of the system	°C		
Type of bearing			
Manufacturer of motor			
Place of manufacturing of motor			
VFD manufacturer			
Noise levels at 1 m distance considering sound proof casing	dBA		
Weight per aggregate	kg		
Class of insulation			
Sound proof casing type			
Sound proof casing material			
Depth of casing	m		
Width of casing	m		
Length of casing	m		
Operating point		**Max duty point**	**Reduced duty point**
Motor speed	rpm		
blower capacity (single) @ 0°C and 101 kpa	Nm^3/h		
Discharge pressure after filter, silencer etc.	kPa		
Energy demand at operating point per blower	kWh		
Maximum total power demand at electrical terminal	kW		
Efficiency	%		
Periphary blowers			
Diameter of manifold	mm		
Material of manifold			

Maximum air temperature at the manifold	°C	
Blow off valve type and manufacturer		
connection flanche diameter blow off line	mm	
Intake grit trap, type, size, number		
Intake air filter - silencer type, size , number		
Discharge silencer, type, size, number		
Cooling system type		
Crossflow diffusers		
Manufacturer of diffusers		
Number of diffusers per Membrane cassette		
Number of diffusers total		
Air load per diffuser at operational point	Nm^3/h	
Max. air load per diffuser	Nm^3/h	
Min. air load per diffuser	Nm^3/h	
Pressure loss	kPa	
Pressure loss after five years	kPa	

Equipment list specifications	Units	
Reversible permeate/backwash pumps		

Design parameters		
No. Backwash cycles per day	n/d	
Duration per cycles	seconds	
flowrate backwash	m^3/h	
No. of chemical washes per year	n/a	

General Information		
Manufacturer, place of manufacturing		
Type of reversible pump		
Model of pump		
Weight per aggregate	kg	
Noise levels at 1 m distance	dBA	
Shroud material		
Propeller size	cm	
Propeller material		
Shaft length	cm	
Shaft material		
seal type		
Discharge flanche diameter	mm	

Operational points		Operational point	Max duty point	Reduced duty point
Number of pumps				
Motor speed at 50 Hz.	rpm			
Pumping capacity per pump at 50 Hz.	m^3/h			
Minimum operational frequency	Hz			
Motor speed at minimum frequency	rpm			
Pumping capacity at min frequency (Hz)	m^3/h			
TDH of pumps in permeate suction mode	m			
TDH of pumps in backwash mode	m			
Energy demand	kWh			
Total power demand	kW			
Efficiency	%			

Motor		
Manufacturer, place of manufacturing		
nominal speed	rpm	
Rated power	kW	
Voltage	V	
Insulation class		
Protection IP Rating		
Cooling jacket		
Moisture sensor type		

Equipment list specifications	**Units**	
Reversible permeate/backwash pumps		

Design parameters	**name**	**consumption m³/a**	**purpose**
Chemical 1			
Chemical 2			
Chemical 3			

General Information		
Manufacturer of chemical pumps, place of manufacturing		
Type of chemical pumps		
Number of pumps		
Model of pump		
Weight per aggregate	kg	
Shroud material		
seal type		
Discharge flanche diameter	mm	
Tank size chemical 1	m³	
Tank size chemical 2	m³	
Tank size chemical 3	m³	