The colour primaries used are defined in xyY space.

Red	$x = 0.640$	$y = 0.330$
Green	$x = 0.300$	$y = 0.600$
Blue	$x = 0.150$	$y = 0.060$
White (D65)	$x = 0.3127$	$y = 0.3290$

These are the primaries specified by both ITU-R BT.709 and sRGB. Given these chromanicities, we are given a relationship between the XYZ coordinates and the values of R, G, and B. I'm using the notation and idea from the method described in Foley/van Dam.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} x_r C_r & x_g C_g & x_b C_b \\ y_r C_r & y_g C_g & y_b C_b \\ z_r C_r & z_g C_g & z_b C_b \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

In order to compute the values of C_r, C_g and C_b, we need a known reference point. For this we will use the D65 white point (black body at 6500K) and use unity luminance (Y) and map this to $R = G = B = 1$.

$$\begin{aligned} Y_{D65} &= 1 \\ X_{D65} &= x_{D65} \frac{Y_{D65}}{y_{D65}} \\ &= 0.3127 \frac{1}{0.3290} \\ &= 0.9505 \\ Z_{D65} &= z_{D65} \frac{Y_{D65}}{y_{D65}} \\ &= 0.3583 \frac{1}{0.3290} \\ &= 1.0891 \end{aligned}$$

We can now use these to solve for C_r, C_g and C_b by taking the inverse of the following:

$$\begin{bmatrix} X_{D65} \\ Y_{D65} \\ Z_{D65} \end{bmatrix} = \begin{bmatrix} x_r & x_g & x_b \\ y_r & y_g & y_b \\ z_r & z_g & z_b \end{bmatrix} \begin{bmatrix} C_r \\ C_g \\ C_b \end{bmatrix}$$

We get:

$$\begin{bmatrix} C_r \\ C_g \\ C_b \end{bmatrix} = \begin{bmatrix} 2.0884 & -0.9906 & -0.3213 \\ -1.1553 & 2.2361 & 0.0495 \\ 0.0669 & -0.2454 & 1.2718 \end{bmatrix} \begin{bmatrix} 0.9505 \\ 1 \\ 1.0891 \end{bmatrix}$$
$$= \begin{bmatrix} 0.6444 \\ 1.1919 \\ 1.2033 \end{bmatrix}$$

Submitting back, we get the final matrix:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} x_r C_r & x_g C_g & x_b C_b \\ y_r C_r & y_g C_g & y_b C_b \\ z_r C_r & z_g C_g & z_b C_b \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$
$$= \begin{bmatrix} 0.4124 & 0.3576 & 0.1805 \\ 0.2126 & 0.7152 & 0.0722 \\ 0.0193 & 0.1192 & 0.9505 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Inverting this we get the desired matrix:

$$\begin{bmatrix} R_{sRGB} \\ G_{sRGB} \\ Z_{sRGB} \end{bmatrix} = \begin{bmatrix} 3.2406 & -1.5372 & -0.4986 \\ -0.9689 & 1.8758 & 0.0415 \\ 0.0557 & -0.2040 & 1.0570 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$