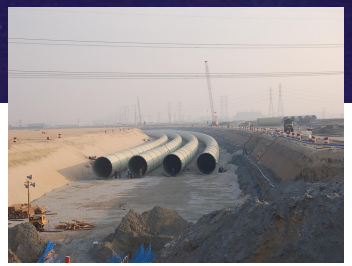
ROYAL COMMISSION FOR JUBAIL & YANBU



Sea Water Cooling System For Jubail 2

December 2007

Content

- RC Mission and Achievements
- Project Management Tools
- Sea Water Cooling in Jubail 1
- Jubail 2 Sea Water Cooling
  - Feasibility & Concept
  - System Overview
  - Project Status.

Royal Commission Mission

- Strategic Master Planning of the development and the future growth
- Provide land and utilities for industrial development.
- Promote industrial, residential and commercial investment.
- Develop , operate and maintain public facilities and services.
- Comprehensive Management of the two cities.

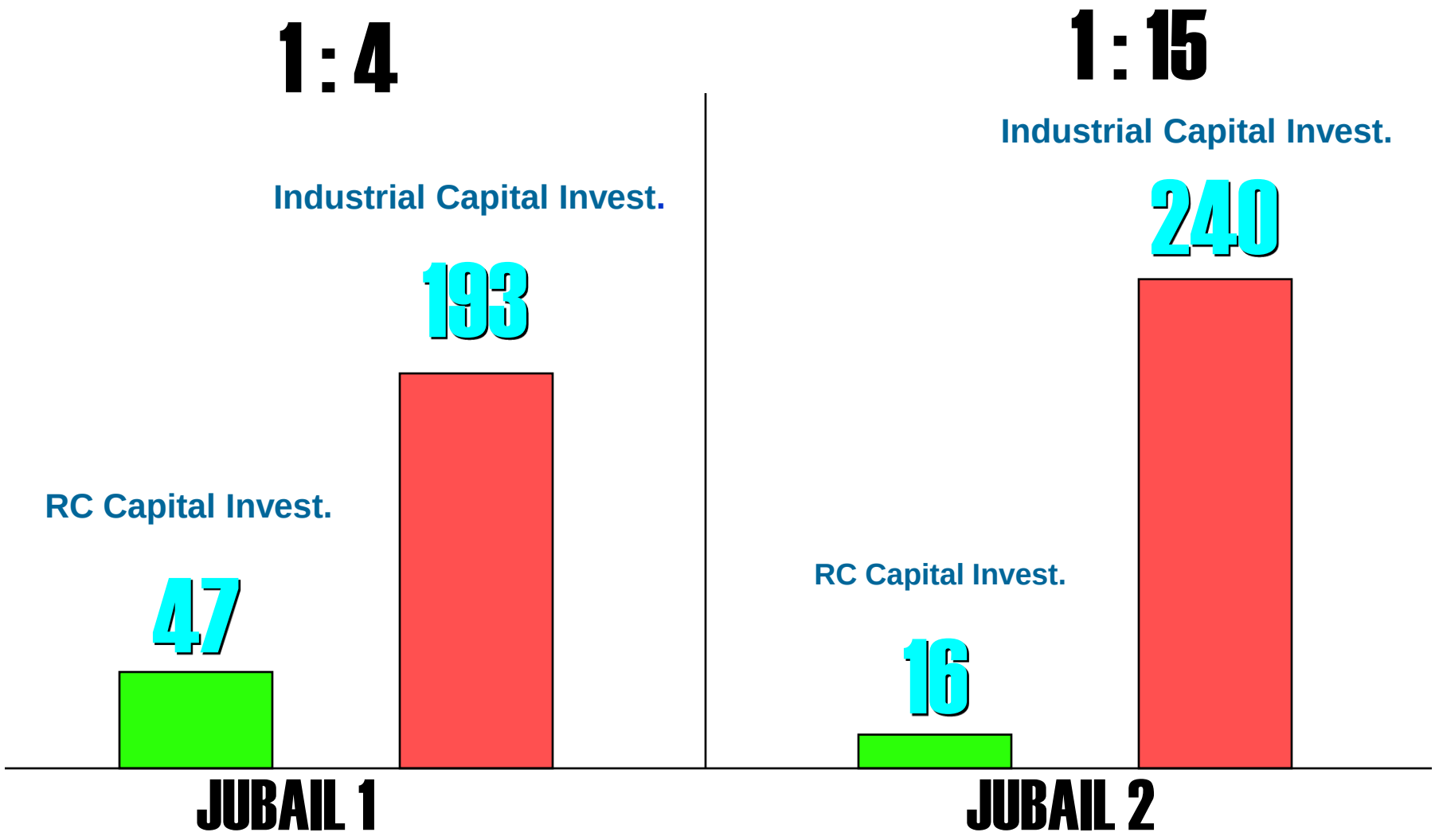
Achievements (In Jubail)

- Produces 7% of the world's petrochemicals.
- Contributes 11.5% of the Kingdom's non-oil GDP.
- Creates 70% of the Kingdom's non-oil exports.
- Annual growth is sustained at 6%.
- Jubail has attracted over 50% of the Kingdom's total foreign investment.

Jubail is the Best City in attracting foreign investment, award by Financial Times , 2005

RC & Industrial Sector Capital Investment

(SR Billion)



Project Life (Gate Process)

PHASES	PLANNING PHASE			PROCESS PHASE						IMPL - PHASE			
STAGES	STAGE 1	1	STAGE 2	2	STAGE 3	3	STAGE 4	4	STAGE 5	5	STAGE 6	6	
AVG-DURATION	2 W		2 W		24 W		16 W		4 W		104 W		
RANGE	1 - 3 W		1 - 3 W		16 - 48 W		12 - 24 W		2 - 12 W		52 - 208 W		
STG-NAME	CONCEPT		PLAN COMTT		DESIGN		CONTRACTING		APPROVALS		EXCUTION		
DESCRIPTION	BREIF SCOPE ROUGH COST WHY DO WE NEED THE PROJECT	GATE KEEPER DDG	BREIF SCOPE SCHEMATIC DEWG COST +- 25 % BUDGET VERIFICATION PROCESS CICLE (STGs (3-6)) PROJECT NEED PROJECT TITLE	GATE KEEPER PLAN COMMT	DISCUSS A/E 2 W 30% DESIGN 4 W VE+ DEPTS REV 2 W 90% DESIGN 12 W DEPTS REVIEW + 2 W 100 % DESIGN 2 W TRANSLATION	GATE KEEPER P & B	RFP 2 W ISSUE FOR BIDS 8 W RC EST EVALUATION+RE 3 W NDATION DG APPROVAL 2 D NEGT BIDDER 3 W	GATE KEEPER PROC	CHAIRMAN 2 W MOF 2 W PARALELL BOARD 2 W COM 4 W	GATE KEEPER MOF	AWARD & NTP SCHEDULE MILESTONS TURN OVER	GATE KEEPER O&M
CUSTUDY	PROJECT SPONSOR		PROJECT SPONSOR		PROJECT SPONSOR		PROCURMT- DEPT		PROCURMT DEPT		CONST/ENG		
IMPL- TOOL	TO BE PREPARED BY REQUESTER THRU AFORMAT FORM - A		TO BE PREPARED BY REQUESTER THRU POWER POINT PRESENTATION FORM -B		REVISED CFR		REVISED CFR		REVISED CFR		CONST/ENG		

1 GO
HOLD
CANCEL
GATE KEEPER

CFR Report

Category/Contract No./ Description	STAGE 1	STAGE 2	STAGE 3				
	Contract Initiating Meeting (0)	Planning Committee Presentation (PC)	Planning Committee Approval (Start of Eng) (ABC)	Tech Specs Initiated (1)	Complete 30% Package Review (30)	Complete 90% Package Review (90)	Tech Specs 100% to Proc't (3)
standard days					56	98	14
COMMUNITY							
JUBAIL 1							
TECHNICAL							
1-06-092-T26	1-Oct-06 P	26-Nov-06 P	10-Dec-06 P	7-Jan-07 P	N/A P	10-Jun-07 P	6-Aug-07 P
Engineering Design for Roads	1-Oct-06 A	26-Nov-06 A	10-Dec-06 A	7-Jan-07 A	N/A F	10-Jun-07 F	6-Aug-07 F
1-99-101-T15	12-Aug-06 P	7-Oct-06 P	21-Oct-06 P	18-Nov-06 P	13-Jan-07 P	21-Apr-07 P	26-May-07 P
Study and Design of City Center	12-Aug-06 A	7-Oct-06 A	21-Oct-06 A	18-Nov-06 A	13-Jan-07 A	21-Apr-07 F	26-May-07 F
SITE DEVELOPMENT							
1-91-709-C12	8-Apr-07 P	3-Jun-07 P	17-Jun-07 P	15-Jul-07 P	28-Oct-07 P	27-Jan-08 P	6-Apr-08 P
Construction of International Residential Area (Phase I)	8-Apr-07 A	3-Jun-07 A	17-Jun-07 A	15-Jul-07 F	28-Oct-07 F	27-Jan-08 F	6-Apr-08 F
1-91-709-C13	9-May-07 P	4-Jul-07 P	18-Jul-07 P	15-Aug-07 P	28-Nov-07 P	27-Feb-08 P	7-May-08 P
Site Development Works in Community Area (Farouk North Area)	9-May-07 A	4-Jul-07 A	18-Jul-07 A	15-Aug-07 F	28-Nov-07 F	27-Feb-08 F	7-May-08 F
1-91-740-C03	9-Aug-07 P	4-Oct-07 P	18-Oct-07 P	15-Nov-07 P	21-Feb-08 P	11-May-08 P	20-Jul-08 P
Rehab and Improvement of Shorelines in all existing Community are	9-Aug-07 A	4-Oct-07 A	18-Oct-07 A	15-Nov-07 F	21-Feb-08 F	11-May-08 F	20-Jul-08 F
IRRIGATION							
1-59-575-C27	4-Mar-07 P	29-Apr-07 P	13-May-07 P	10-Jun-07 P	15-Sep-07 P	22-Dec-07 P	17-Feb-08 P
Reinforcement of Community Irrigation System	4-Mar-07 A	29-Apr-07 A	13-May-07 A	10-Jun-07 F	15-Sep-07 F	22-Dec-07 F	17-Feb-08 F

Sea Water Cooling Need

- Heat rejection from industries.
- Cooling media is required to absorb heat
- *The System provide Sea Water to be the cooling media to absorb heat from industries and dissipate into the Sea.*
- The System provides as a proper environmental control for industries discharge

Feasibility of SWC of Jubail 1

Looking at J 1 , Canal System was Selected because:

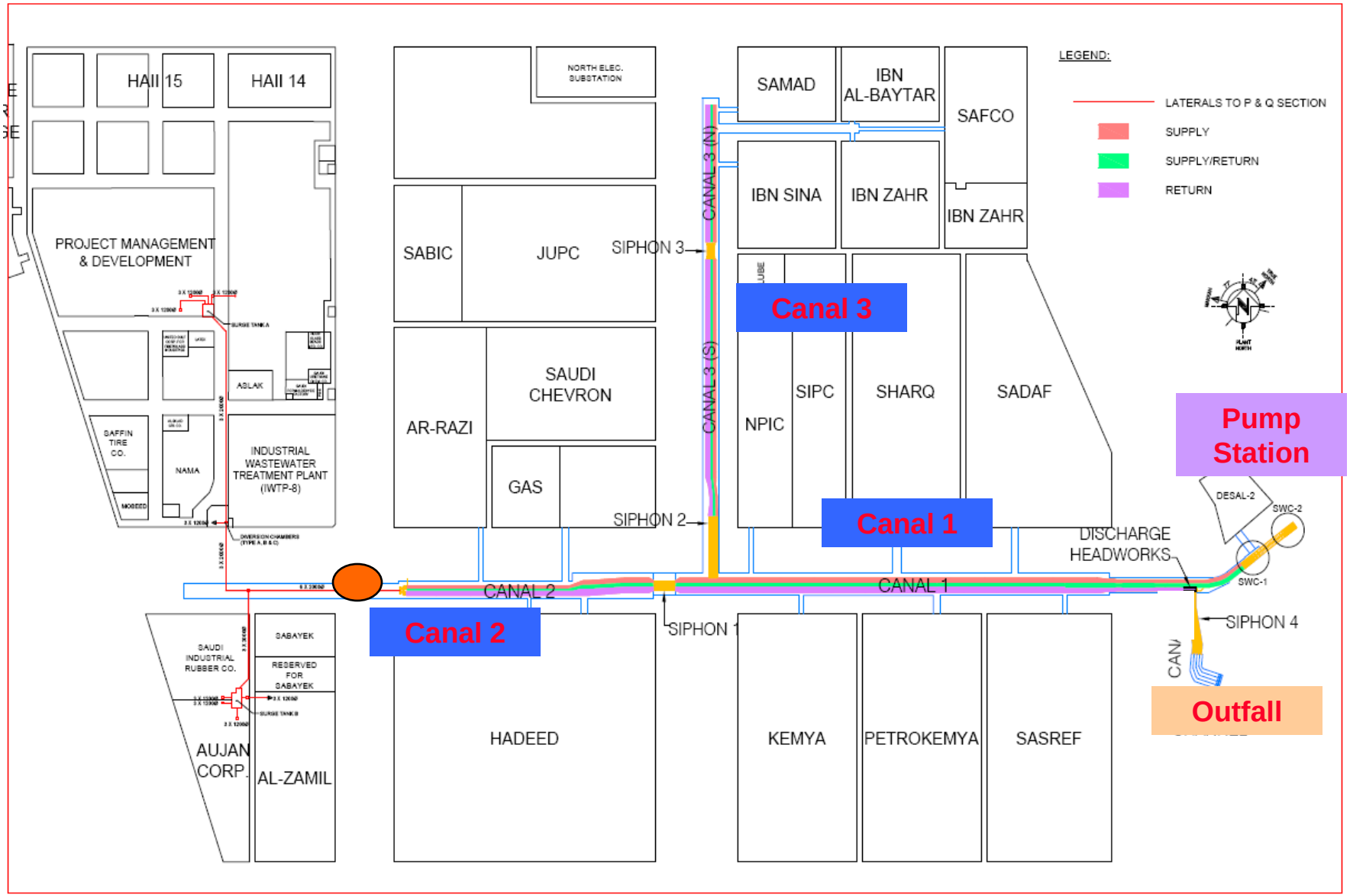
- *Favorable site location – near Gulf*
- *Level topography permitting canals*
- *Ideal arrangement of Industrial Port Causeway to separate intake from outfall.*

SWC System in Jubail 1 (1 m m3/hr)

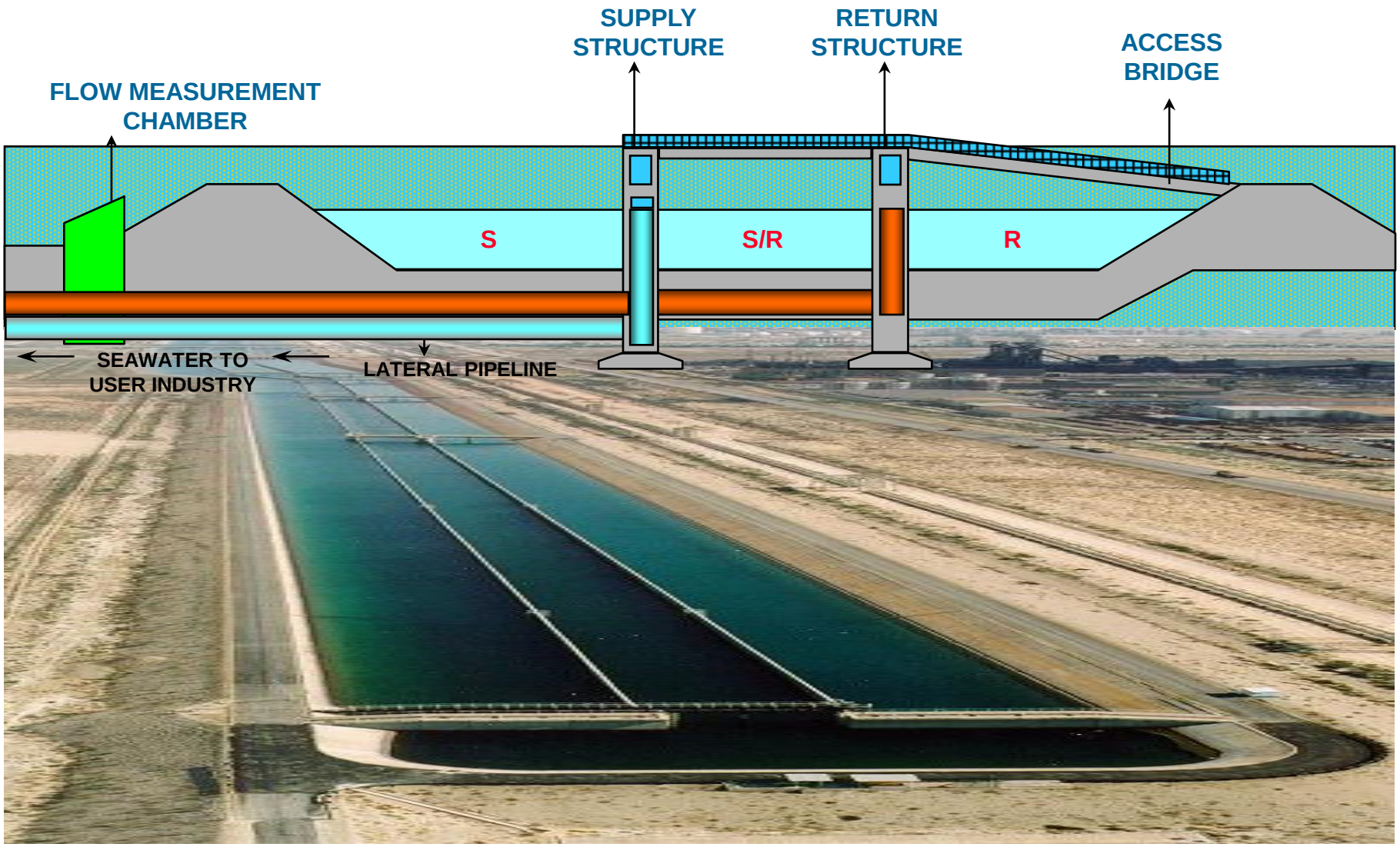
- ***Sea Water Intake Channel***
- ***Pump Station***
- ***Canal System***
  - ***3 Canals segments with 3 Compartments (Supply , Supply / Return , Return)***
  - ***Inverted Siphons between canals segments***
  - ***Industries Off-Take Structures and Laterals Pipes***
  - ***Outfall Structure***

Intake Channel & Pump Station

Canal System



Off-Take Structure



Outfall

JUBAIL 2

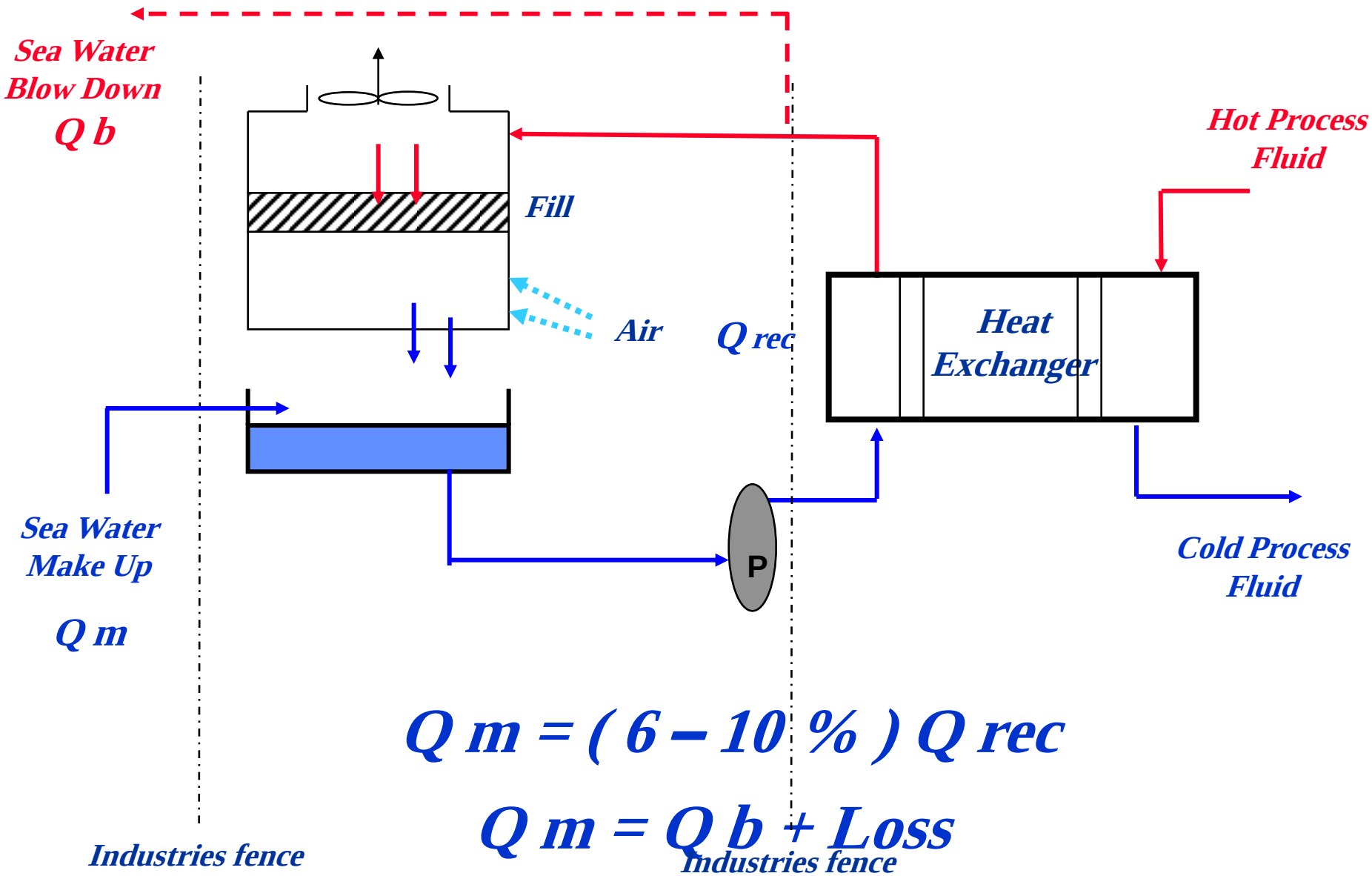
STAGES	AREA (KM2)	GOVERNMENT INVESTMENT (SR BILLION)	PRIVATE INVESTMENT (SR BILLION)	COMPLETION DATE	NO. OF INDUSTRIES Lots	PRODUCTION CAPACITY (KTPY)
1ST	19	5.0	82	2009	7	24,000
2ND	20	6.3	80	2011	3	13,000
3RD	23	4.7	78	2013	4	12,000
4TH	19	-	Planning Stage		-	-
TOTAL	81	16.0	240		14	49,000

Feasibility of Jubail 2

For J 2 many option were studies

- Canal for once through found not feasible due to location and crossing KRT and topography (+ 7 m E-W , + 3 N-S)
- Cooling Ponds required large space.
- Dry cooling , High cost and not in large scale.
- Advanced technology of using Gases such as Ammonia. Limited to small scale
- ***Make Up water for Cooling Towers found most feasible.***

Make Up Concept For J 2



$$Q\,m = (6 - 10\,\%)\,Q\,rec$$

$$Q\,m = Q\,b + Loss$$

Cooling Towers

Heat rejection device

20 % Convective Heat Transfer

80 % Evaporative Cooling , Mass Transfer (1.5 % Loss of water)

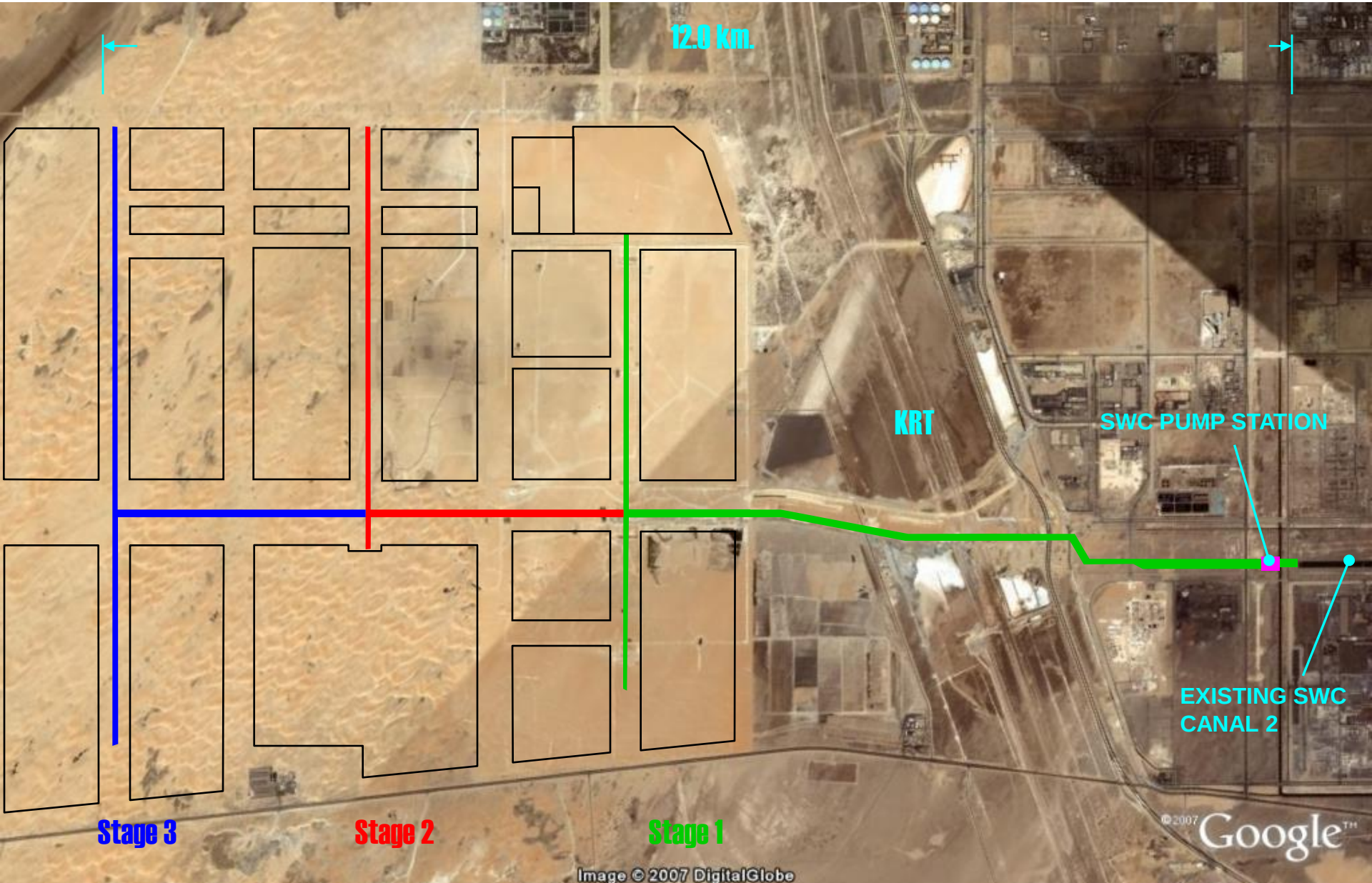
Mechanical Draft

Fan Assisted Natural Draft

Scope of SWC System for J 2

- Headwork and demolish end of canal 2
- 200,000 m3/hr Pump station (4 + 2 Pumps)
  50,000 m3/hr each , 23 m head , 4 MW
- 5 Pipes configuration (2 S , 1 S/R , 2 R)
- Distribution Manifolds

Overall System

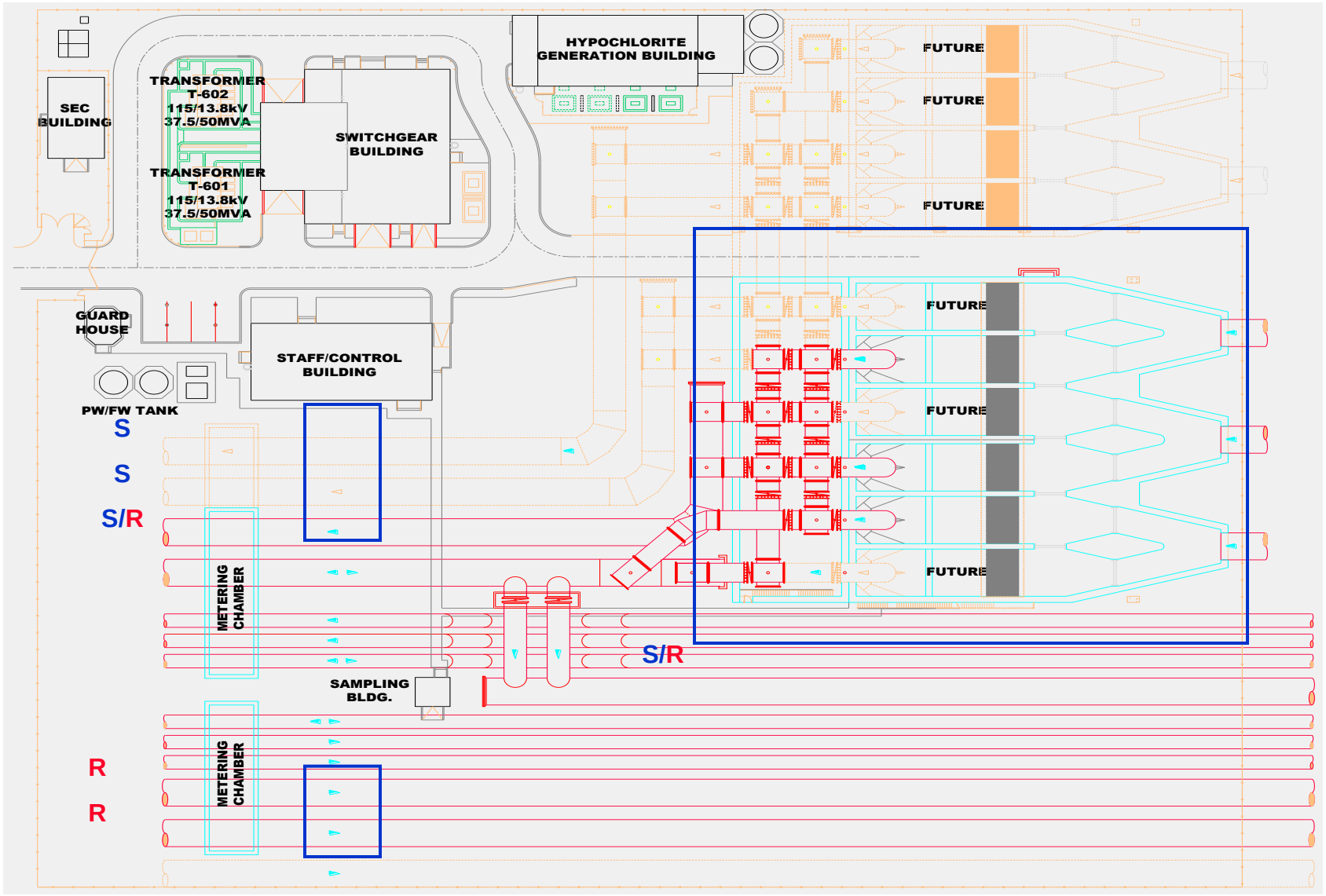


Headwork : Cofferdam

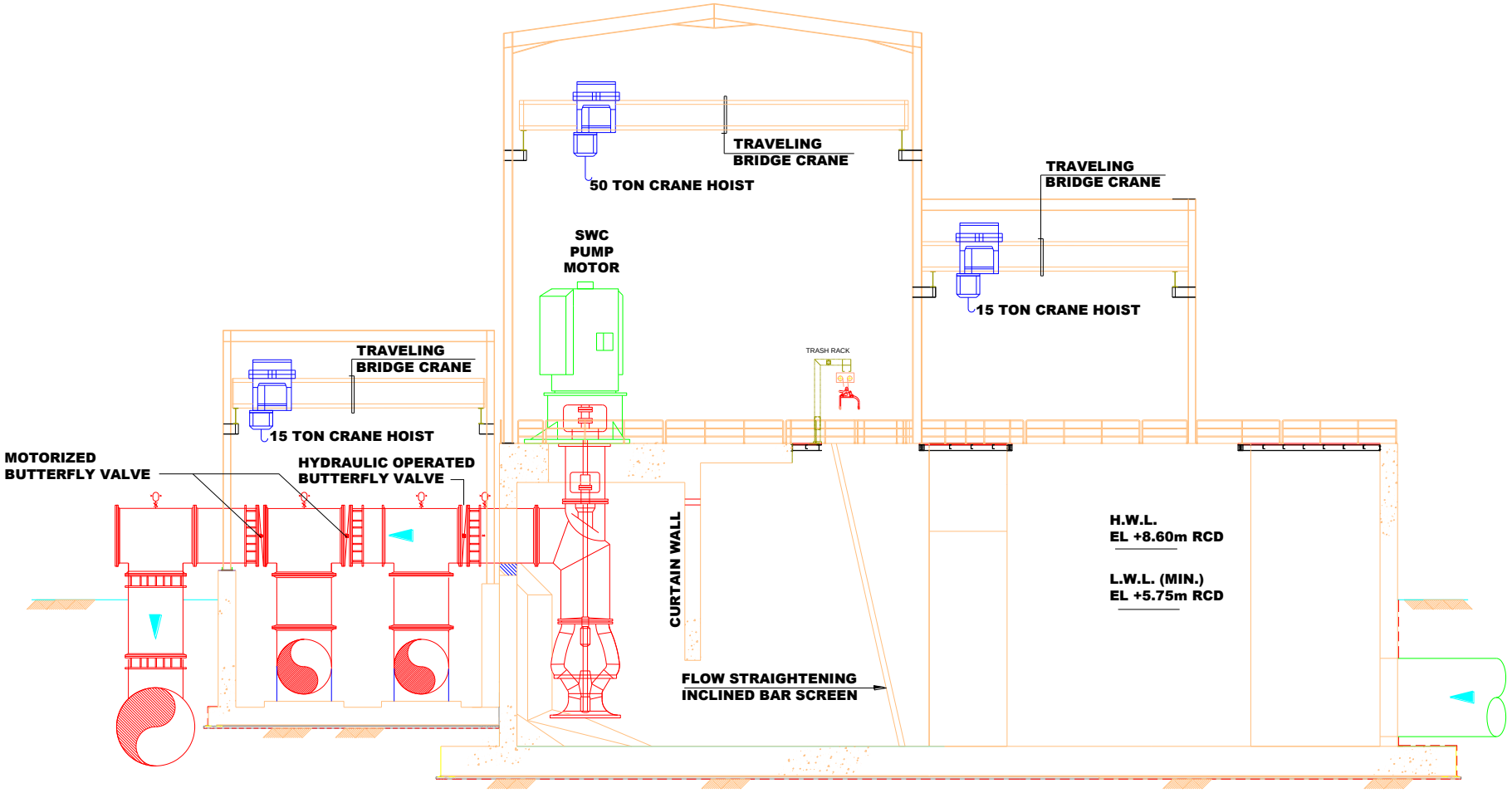
Headwork : Demolish

Headwork : Rebuild

J 2 Pump House Layout



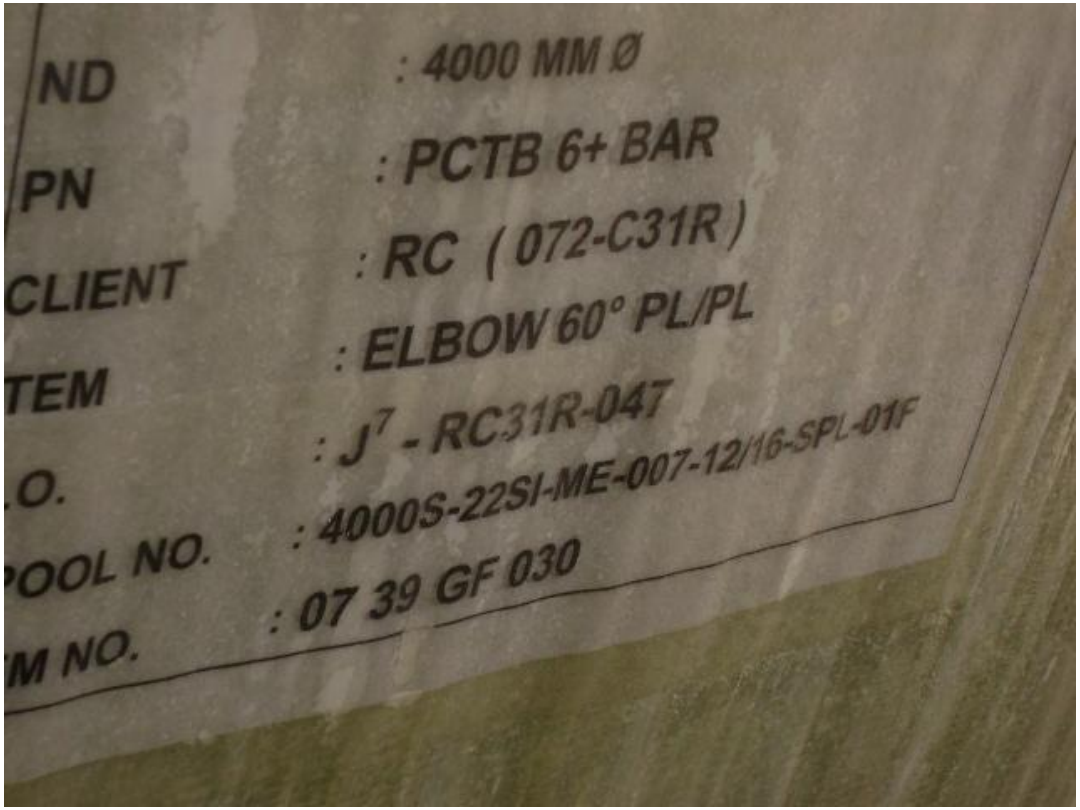
J 2 Pump House Section



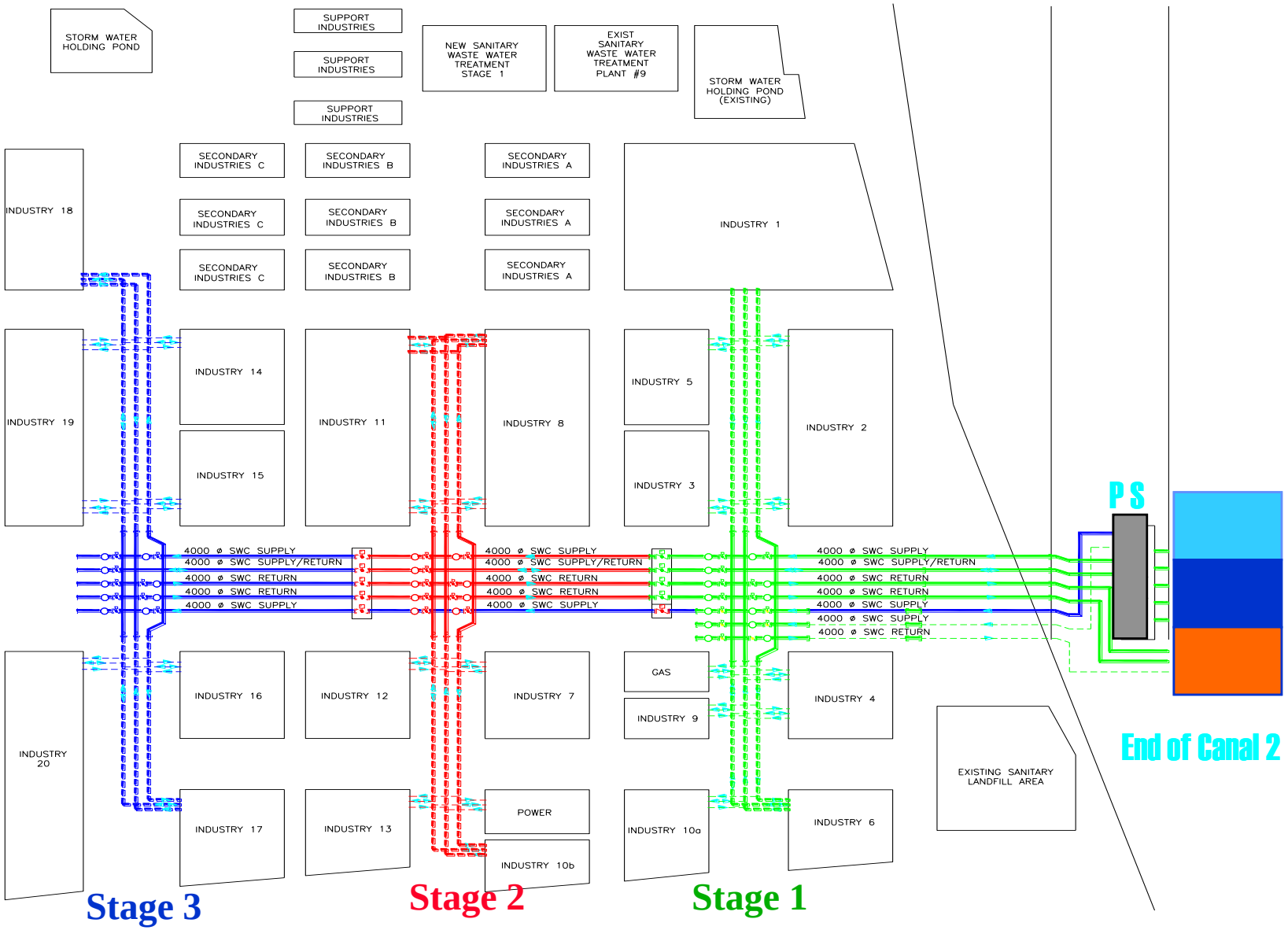
J 2 Pump House Construction

Piping

- *4 m for East West Piping 55 km*
- *3 m for North South Laterals 21 km*
- *2 m for industry connection*
- *Valves 4 m (31) / 3m (21) / 2m (66)*



Piping Configuration

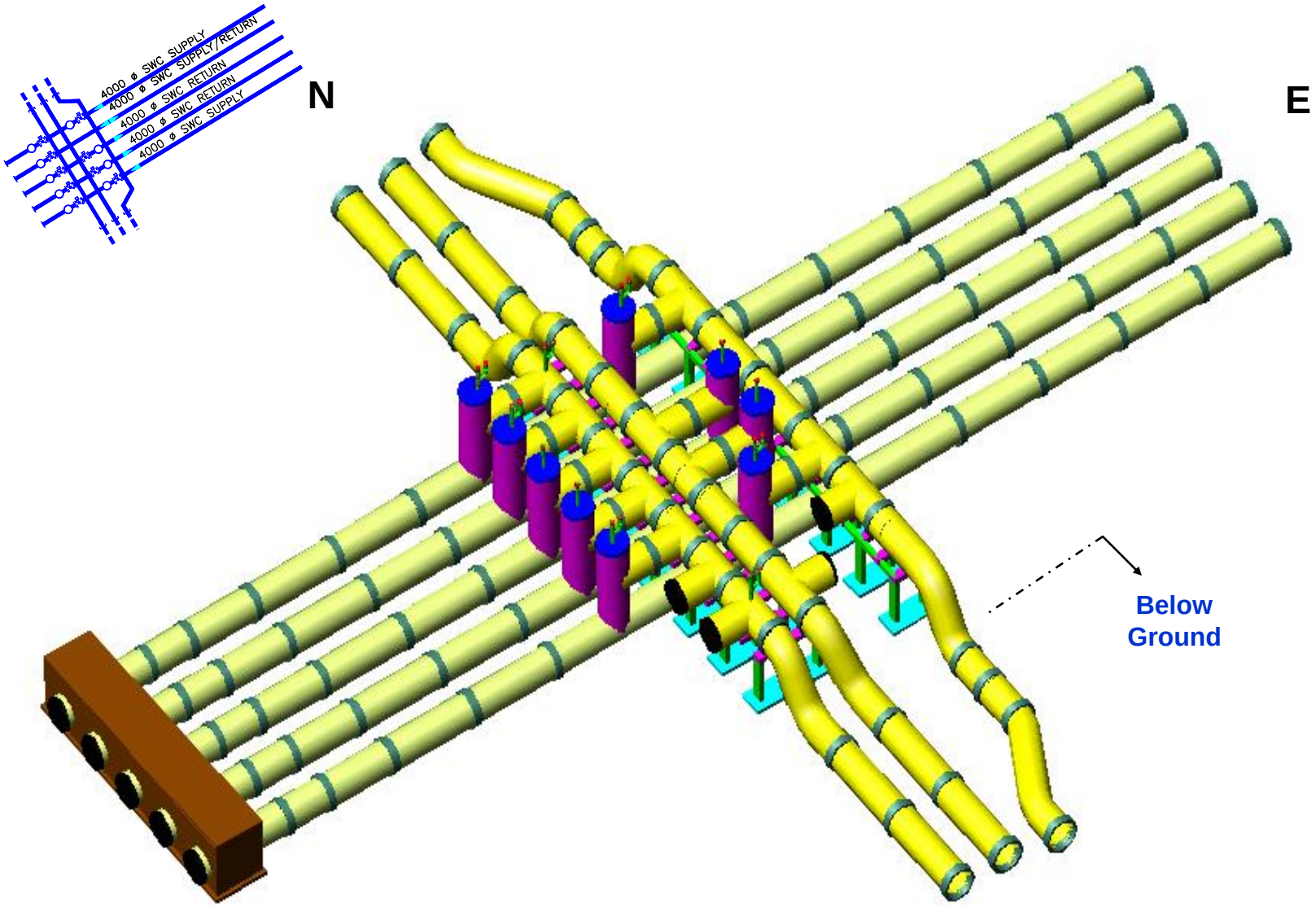


KRT Area

Under Aramco Pipes

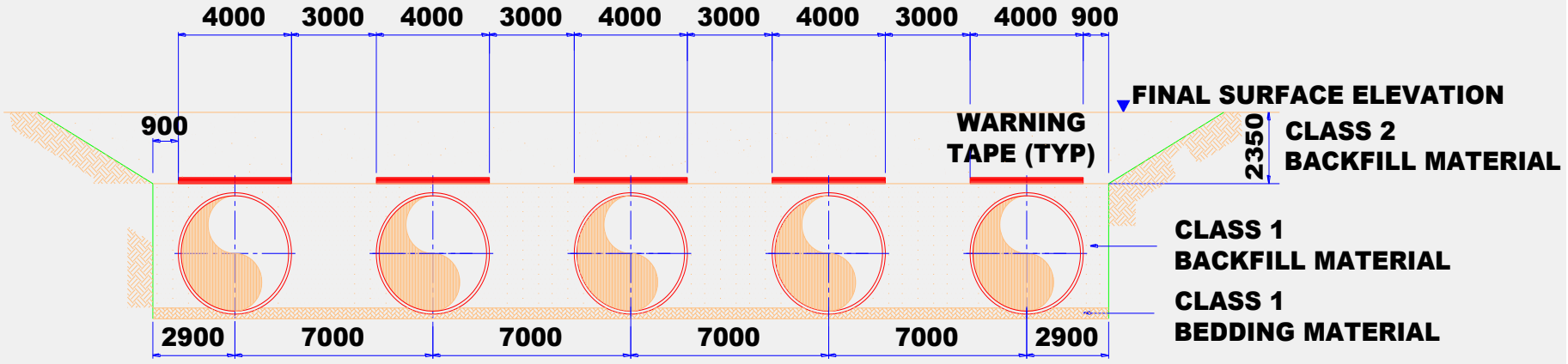
At Stage 1 , Air-Vent valve 500mm

Manifold 3 D


4000 ø SWC SUPPLY
4000 ø SWC SUPPLY/RETURN
4000 ø SWC RETURN
4000 ø SWC RETURN
4000 ø SWC SUPPLY
N
E
Below
Ground

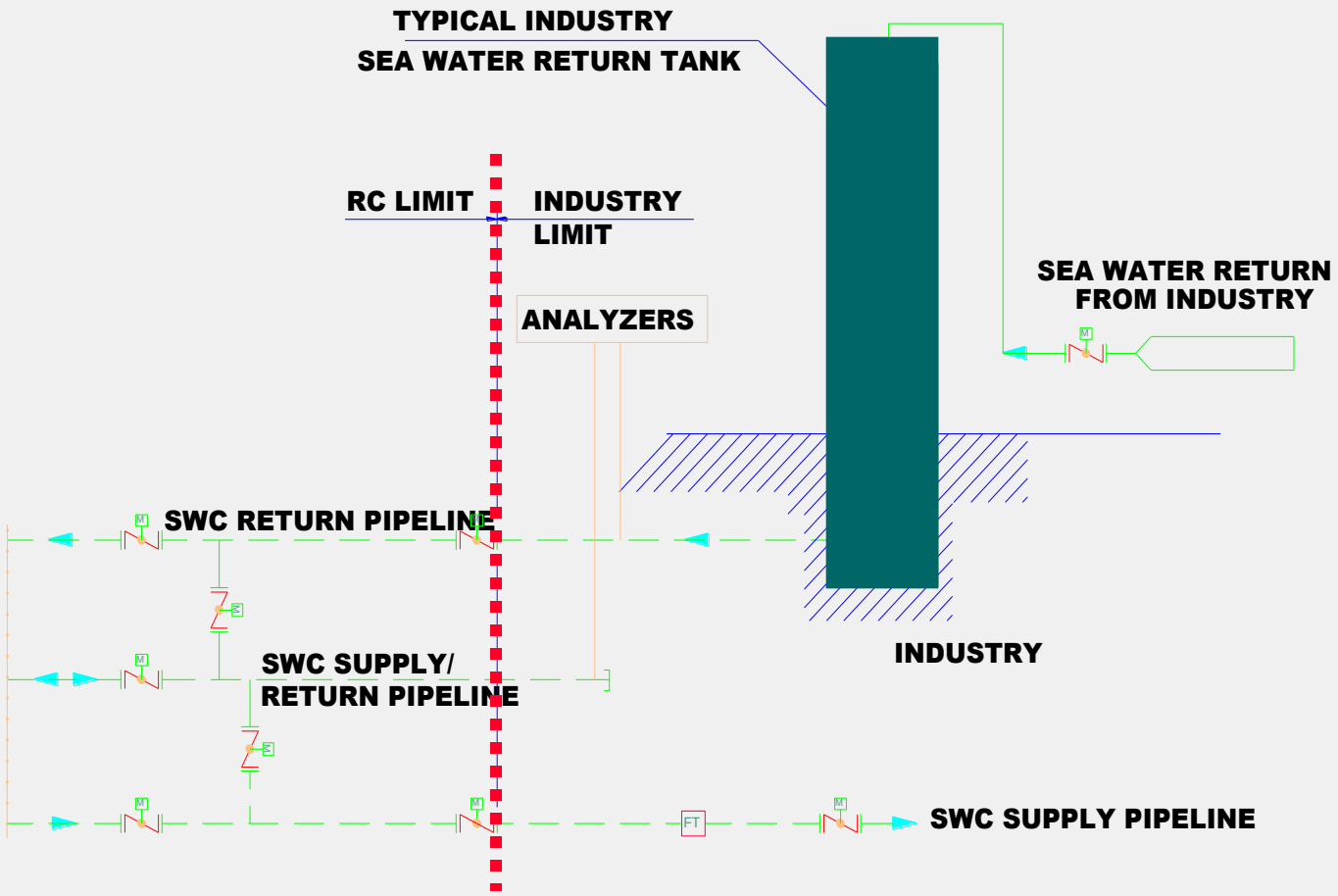
Manifold

Trenching Detail



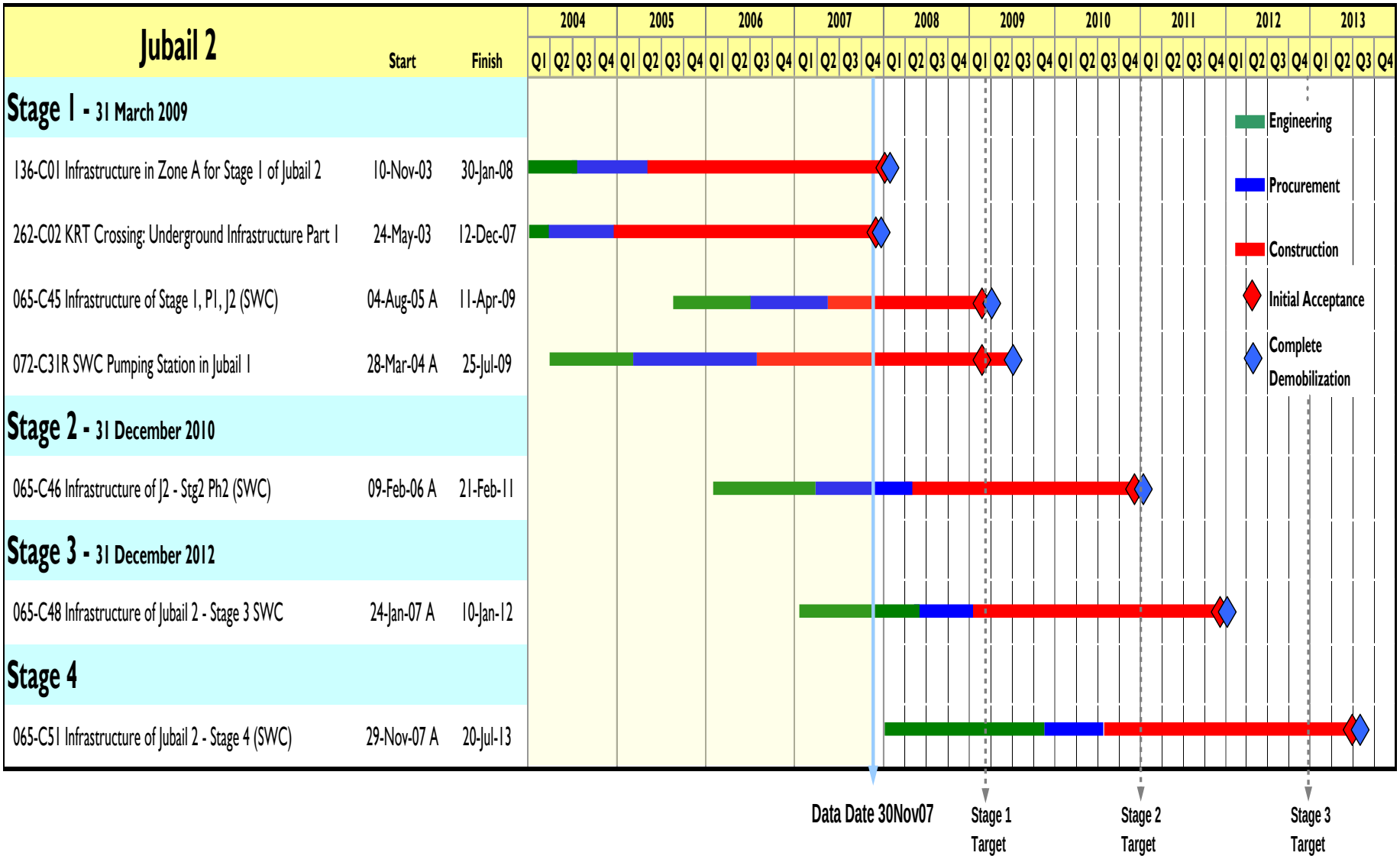
TYPICAL TRENCH FOR 5 - DN 4000 SWC PIPES
UNPAVED AREAS

Industry Connection



INDUSTRY CONNECTION DETAIL

SWC - EPC Schedule



Thank you