Annex 3.4

Laboratory Test for Filter and Embankment Material

Annex 3.4 Laboratory Test for Filter and Embankment Material

(i) Embankment material

In all reservoir types mentioned in this report, embankment materials such as Rock, Filter and Impervious core are required to construct them. Execution of following laboratory tests is recommended in order to grasp material characteristics and its available volume.

- Rock/Filter Material

  Sieve analysis shall be done against Cobble/Boulder, gravel and sand material obtained from Wadi riverbed which locates the area between about 2km from the pershall flume to the road bridge. Target sampling interval will be taken once per 200m.

- Impervious Core Material

  Physical property（Gradation Curve, Specific Gravity, Moisture Content and Plasticity）
  Compaction test
  Permeability test (if possible)
  Target materials : Proposed area of Wadi ‘Auja and Wadi Far’a.

(ii) Filter Test

Following laboratory test is recommended to confirm effect of filter function as a model of the filter dam.

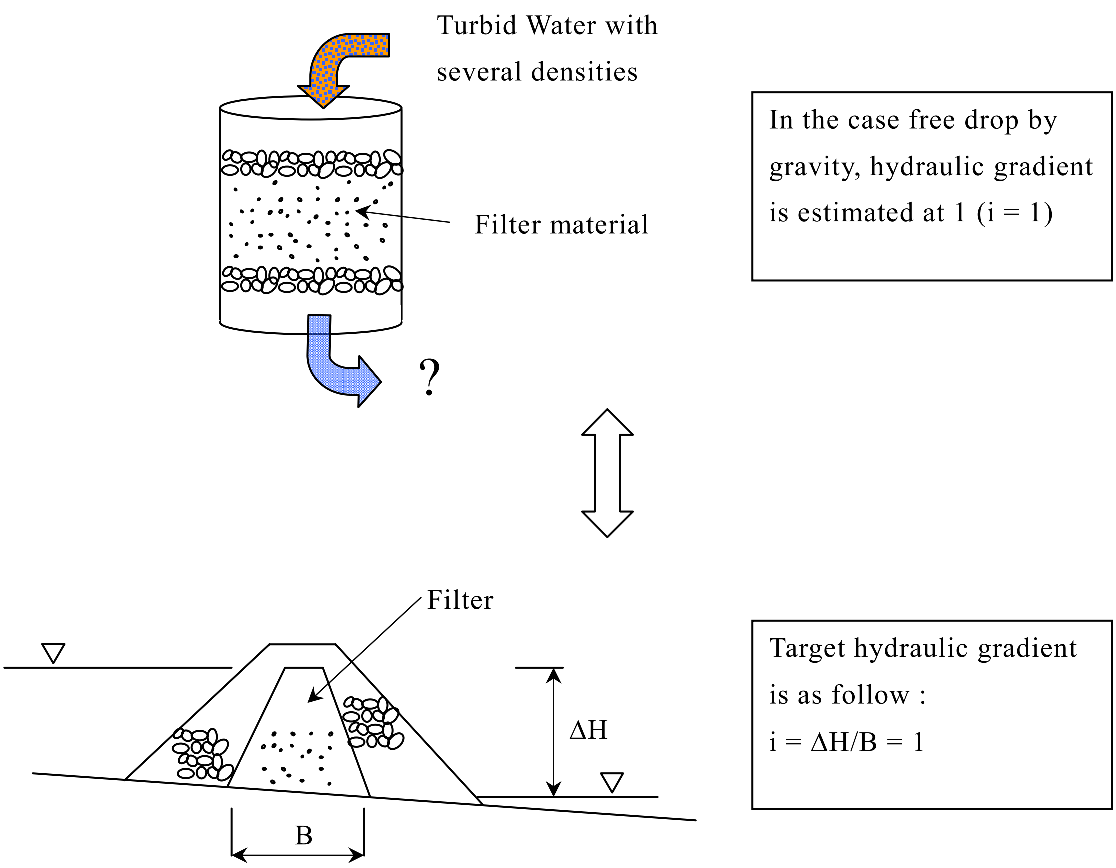


Figure 3.4.1 Proposed Filter Test

Annex 3.5

Hydraulic Calculation

Annex 3.5 Hydraulic Calculation
(Downstream area of Wadi Qilt)

Hydraulic Calculation of Intake Facilities

(1) Determination of channel width (B)

$Q = 10\ m^3/sec$ (assumed intake discharge from flood water)

$Fr = 0.5$ (taken as a target Froude number)

$d = 0.463 \cdot (Q/Fr)^{(2/5)}$

$= 1.535\ m$

$B = 2d$ (favorable condition)

$= 3.07$

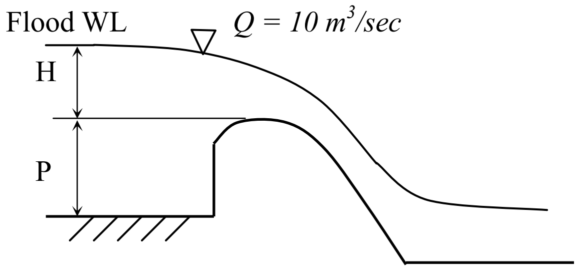
$\boxed{B = 3.2\ m}$

(2) Overflow depth and crest length of over-flow weir

Relation between overflow depth and crest length of overflow weir is expressed as below.

$Q = C \cdot L \cdot H^{3/2}$

where,
- Q : Discharge (m^3/sec)
- C : Discharge coefficient (say 2.0)
- L : Effective length of weir (m)
- H : Total head above weir crest (including approach velocity head)
- P : Height of weir



Capacity of the overflow section is examined based on the design flood discharge of 10 m^3/sec. Overflow depth and crest length of the overflow weir is tentatively designed to be 0.7 m and 10 m respectively, in accordance with the trial calculation as shown below.

Overflow Depth Hd (m)	Crest Length L (m)
0.60	10.76
0.65	9.54
0.70	8.54

⇨ *Hd = 0.7m*
L = 10m

(3) Hydraulic calculation for each section

Side channel type of intake facility is planned to catch the flood water from wadi. Proposed intake facility consists of four (4) parts, namely (1) Overflow section, (2) Transition section, (3) Steep chute section and (4) dissipater. Given conditions for hydraulic calculation of intake facility is shown in the table below. In this hydraulic calculation, elevation of control point is taken at EL.0 as a convenient treatment. Hydraulic calculation results for each section are shown hereinafter.

Table 3.5.1 Given Conditions for Hydraulic Calculation

Design Discharge	Inlet	m^3/s	10.0	
	Dissipater	m^3/s	10.0	
C. of Roughness			0.015	
Transition Section	Length	m	9.00	
	Cal. Interval	m	2.00	≧ 0.8
	Width	m	3.20	
	EL at beginning Point	EL	0.00	**Control P.**
	EL at end Point	EL	0.00	
	Height of weir	m	0.60	
	Slope gradient	1 :		level
	Gradient of wall	R	0.00	vertical
		L	0.00	vertical
Overflow Section	Length	m	10.00	
	Cal. Interval	m	1.00	≧ 0.9
	Width at beginning Point	m	3.20	
	Width at end Point	m	1.60	
	EL at beginning Point	EL	0.00	
	EL at end Point	EL	0.20	
	Slope gradient	1 :	50.00	
	Gradient of wall	R	0.70	vertical
		L	0.00	vertical
Steep Chute Section	Length	m	24.00	
	Cal. Interval	m	3.00	≧ 2.0
	Width	m	3.20	
	EL at beginning Point	EL	0.60	
	EL at end Point	EL		-2.40
	Slope gradient	1 :	8.00	
	Gradient of wall	R	0.00	vertical
		L	0.00	vertical

Source: JICA Study Team

Table 3.5.2 Hydraulic Calculation of Transition Section

Discharge	10.000 (m^3/s)	Roughness	0.015	Slope	= 1 /	1E+11	
EL.at B.P.	0.000 (m)	Width	3.200 (m)				
		Depth at B.P.	1.599 (m)	Height of Weir =		0.600 (m)	

Increased distance (m) ①	Unit distance (m) ②	Depth h(m) ③	Area $A(m^2)$ ④	Velocity v(m/s) ⑤	Velocity Head $v^2/2g$(m) ⑥	Wetted Perimeter P(m) ⑦	H.M.D R(m) ⑧	$R^{(4/3)}$ ⑨	Co. of friction S_f ⑩	S_f' ⑪	Friction headloss (m) ⑫	Bottom (EL. m) ⑬	EL. of energy (m) ⑭	EL. of energy (m) ⑮	Error ⑮－⑭ ⑯	Froude number ⑰
0.000	0.000	1.599	5.117	1.954	0.195	6.398	0.800	0.742	0.00116			0.000	1.794			0.494
2.000	2.000	1.603	5.130	1.949	0.194	6.406	0.801	0.744	0.00115	0.00115	0.002	0.000	1.797	1.796	-0.001	0.492
4.000	2.000	1.607	5.142	1.945	0.193	6.414	0.802	0.745	0.00114	0.00115	0.002	0.000	1.800	1.799	-0.001	0.490
6.000	2.000	1.610	5.152	1.941	0.192	6.420	0.802	0.746	0.00114	0.00114	0.002	0.000	1.802	1.802	-0.000	0.489
8.000	2.000	1.613	5.162	1.937	0.192	6.426	0.803	0.747	0.00113	0.00113	0.002	0.000	1.805	1.804	-0.000	0.487
9.000	1.000	1.615	5.168	1.935	0.191	6.430	0.804	0.747	0.00113	0.00113	0.001	0.000	1.806	1.806	-0.000	0.486

Source: JICA Study Team

Table 3.5.3 Hydraulic Calculation of Over-flow Section

Discharge	10.000 (m^3/s)	Overflow L	10.00 (m)	Slope	= 1 / 50
EL. at B.P.	0.000	Width at B.P.	3.200 (m)	Side slope	= 1 : 0.70
		Width at E.P.	1.600 (m)	Side slope	= 1 :
		Depth at B.P.	1.615 (m)		

Increased distance (m) ①	Unit distance (m) ②	Bottom (EL. m) ③	D h ' (m) ④	Waterlevel (EL. m) ⑤	Depth H (m) ⑥	Width B (m) ⑦	Area A (m^2) ⑧	Discharge Q (m^3/S) ⑨	Velocity V (m/S) ⑩	Q_1+Q_2 ⑪	$\frac{Q_1}{g*⑪}$ ⑫	V_1+V_2 ⑬	D v ⑭	$\frac{q V_2 \Delta x}{Q_1}$ ⑮	⑭+⑮ ⑯	D h ⑫*⑬*⑯ (m) ⑰	Error ④−⑰ ⑱	Froude number Fr ⑲
0.000	0.000		—	1.615	1.615	3.200	6.081	10.000	1.644	—	—	—	—	—	—	—	—	0.443
1.000	1.000	0.020	0.048	1.663	1.643	3.040	5.940	9.000	1.515	19.000	0.054	3.159	0.129	0.151	0.280	0.048	-0.000	0.406
2.000	1.000	0.040	0.045	1.708	1.668	2.880	5.778	8.000	1.385	17.000	0.054	2.900	0.130	0.154	0.284	0.045	-0.001	0.370
3.000	1.000	0.060	0.042	1.750	1.690	2.720	5.596	7.000	1.251	15.000	0.054	2.636	0.134	0.156	0.290	0.041	-0.001	0.334
4.000	1.000	0.080	0.039	1.789	1.709	2.560	5.397	6.000	1.112	13.000	0.055	2.363	0.139	0.159	0.298	0.039	-0.000	0.296
5.000	1.000	0.100	0.036	1.825	1.725	2.400	5.181	5.000	0.965	11.000	0.056	2.077	0.147	0.161	0.308	0.036	-0.000	0.257
6.000	1.000	0.120	0.033	1.858	1.738	2.240	4.950	4.000	0.808	9.000	0.057	1.773	0.157	0.162	0.319	0.032	-0.001	0.216
7.000	1.000	0.140	0.028	1.886	1.746	2.080	4.699	3.000	0.638	7.000	0.058	1.446	0.170	0.160	0.330	0.028	-0.000	0.171
8.000	1.000	0.160	0.023	1.909	1.749	1.920	4.429	2.000	0.452	5.000	0.061	1.090	0.186	0.151	0.337	0.022	-0.001	0.122
9.000	1.000	0.180	0.016	1.925	1.745	1.760	4.137	1.000	0.242	3.000	0.068	0.694	0.210	0.121	0.331	0.016	-0.000	0.066
10.000	1.000	0.200	0.006	1.931	1.731	1.600	3.818			1.000	0.102	0.242	0.242		0.242	0.006		

Source: JICA Study Team

Table 3.5.4 Hydraulic Calculation of Steep Chute Section

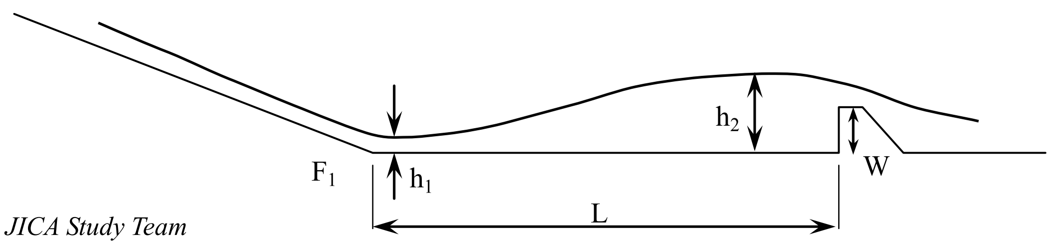
Discharge	10.000 (m^3/s)	Roughness	0.015	Slope	= 1 /	8.000
EL.at B.P.	0.600	Width	3.200 (m)		(	7.125 degree)
EL.at E.P.	-2.400	Depth at B.P.	0.999 (m)			

Increased distance (m) ①	Distance		Depth		Area	Velocity	Velocity Head	Wetted Perimeter	H.M.D		Co. of friction		Friction headloss (m) ⑫	$h*\cos^2\theta$ (m) ⑬	Bottom (EL. m) ⑭	EL. of energy (m) ⑮	EL. of energy (m) ⑯	Error ⑯−⑮ (m) ⑰	Froude number ⑱
	H-distance (m) ②	S-distance (m) ②'	Vertical h(m) ③	Right-A. h'(m) ③'	$A(m^2)$ ④	v(m/s) ⑤	$v^2/2g$(m) ⑥	P(m) ⑦	R(m) ⑧	$R^{(4/3)}$ ⑨	S_f ⑩	S_f' ⑪							
0.000	0.000	0.000	0.999	0.999	3.197	3.128	0.499	5.198	0.615	0.523	0.00421				0.600	2.098			1.000
3.000	3.000	3.023	0.646	0.641	2.051	4.875	1.213	4.482	0.458	0.353	0.01516	0.00969	0.029	0.631	0.225	2.069	2.069	0.000	1.945
6.000	3.000	3.023	0.560	0.556	1.778	5.624	1.614	4.311	0.412	0.307	0.02318	0.01917	0.058	0.547	-0.150	2.011	2.011	0.000	2.410
9.000	3.000	3.023	0.509	0.505	1.616	6.187	1.953	4.210	0.384	0.279	0.03087	0.02703	0.082	0.497	-0.525	1.925	1.929	0.004	2.781
12.000	3.000	3.023	0.473	0.469	1.502	6.658	2.262	4.139	0.363	0.259	0.03853	0.03470	0.105	0.462	-0.900	1.824	1.821	-0.003	3.105
15.000	3.000	3.023	0.447	0.444	1.419	7.045	2.533	4.087	0.347	0.244	0.04575	0.04214	0.127	0.437	-1.275	1.694	1.696	0.002	3.379
18.000	3.000	3.023	0.427	0.424	1.356	7.376	2.775	4.047	0.335	0.233	0.05261	0.04918	0.149	0.417	-1.650	1.543	1.546	0.003	3.620
21.000	3.000	3.023	0.411	0.408	1.305	7.663	2.996	4.016	0.325	0.223	0.05912	0.05587	0.169	0.402	-2.025	1.372	1.374	0.002	3.833
24.000	3.000	3.023	0.398	0.395	1.264	7.913	3.195	3.990	0.317	0.216	0.06525	0.06219	0.188	0.389	-2.400	1.183	1.184	0.001	4.022

Source: JICA Study Team

Table 3.5.5 Design of Dissipater (End Sill Type)

Design Discharge	Q	=	10.0		m^3/s	
Width of Weir	B	=	3.2		m	
	g	=	9.8		m^2/s	
Vel. of Rapid Flow	v	= (refer to result of "Chute Section")	7.913		m/s	$=0.9\sqrt{(2gH)}$
Depth of Rapid Flow	h_1	= (refer to result of "Chute Section")	0.395		m	
Froude Number	F_1	$= v/\sqrt{(g \cdot h_1)}$	4.022			
Depth of Hydraulic Jump	h_2	$= h_1/2 \cdot (\sqrt{(1+8F_1^2)}-1)$	2.058		m	
Required Length	L	$= 6 * h_2$	12.348	13.0	m	
Formula (Iwasaki)	W/h_1	$= \dfrac{(1+2F_1^2)\sqrt{1+8F_1^2}-1-5F_1^2}{1+4F_1^2-\sqrt{1+8F_1^2}} - \dfrac{3}{2}F_1^{(2/3)} = \dfrac{299.002}{54.286} -$ 3.794				
		=	1.714			
Hight of Weir	W	=	0.677	0.70	m	
Freeboard	F_b	$= 0.1 \cdot (v_1 + h_2)$	0.997			
Hight of Wall	H	$= h_2 + F_b$	3.055	3.10	m	



Source: JICA Study Team

Annex 3.6

Quantity Calculation and Construction Cost

Annex 3.6 Quantity Calculation and Construction Cost

Quantity calculation and construction cost for the storm water harvesting facilities is made against 1) downstream area of Wadi Qilt, 2) Wadi 'Auja and 3) Pilot Project. All of quantity calculation hereinafter is made through the CAD program.

(1) Storm water harvesting facilities at D/S area of Wadi Qilt

Table 3.6.1 Summary of Quantity and Construction Cost

		Plan "A"	Plan "B"	Plan "C"	Remarks
Earth Works					
Excavation	m^3	399,500	570,200	733,700	Common Soil
Embankment	m^3	---	800	---	Common Soil
Spoil	m^3	399,500	569,400	733,700	
Rock	m^3	14,500	23,800	20,300	
Filter	m^3	5,600	9,700	8,000	
Slope protection	m^3	20,600	28,500	28,300	t=1m
Intake Facility					Including Headrace
Excavation	m^3	4,600	4,700	4,500	
Backfill	m^3	1,800	1,800	1,700	
Concrete	m^3	950	970	930	21N-8-25 RC
Weir Structure					
Concrete	m^3		582		21N-8-25 RC
Excavation	m^3		9,200		
Backfill	m^3		1,000		
Protection	m^3		2,350		Gabion
Gate	Nos.		4		B4m*H2m
Storage					
Primary	m^3	22,700	43,600	47,700	Turbid Water
Secondary	m^3	51,300	107,800	126,900	Clean Water
Construction Cost	USD	6,640,000	8,820,000	9,680,000	

Source: JICA Study Team

Table 3.6.2 Summary of Quantity Calculation

C.S. : Construction Site

	Unit	Quantity			Remarks
		Plan "A"	Plan "B"	Plan "C"	
Earth Works					
Excavation	m^3	399,500	569,400	733,700	C.S. --> Spoil bank
Excavation	m^3		800		C.S. --> Stockyard
Embankment	m^3	---	800	---	Stockyard --> C.S.
Rock	m^3	14,500	23,800	20,300	Borrow area --> C.S.
Filter	m^3	5,600	9,700	8,000	Borrow area --> C.S.
Slope protection	m^3	20,600	28,500	28,300	Wire Mat t=1m
Intake Facility					Including Headrace
Excavation	m^3	2,800	2,900	2,800	C.S. --> Spoil bank
Excavation	m^3	1,800	1,800	1,700	C.S. --> Stockyard
Backfill	m^3	1,800	1,800	1,700	Stockyard --> C.S.
Concrete	m^3	950	970	930	21N-8-25 RC
Weir Structure					
Concrete	m^3		582		21N-8-25 RC
Excavation	m^3		9,200		C.S. --> Spoil bank
Backfill	m^3		1,000		Stockyard --> C.S.
Protection	m^3		2,350		Gabion
Gate	Nos.		4		B*H=4m*2m
Countermeasure for Evaporation from 2nd Reservoir	m^2	20,200	25,700	31,500	Porystyrene-boad B･L･t=2*2*0.2 (m)
Gross Strage					
Primary	m^3	22,700	43,600	47,700	Turbid Water
Secondary	m^3	51,300	107,800	126,900	Clean Water
Maintenance					once / ? year
Excavation Filter	m^3	5,600	9,700	8,000	C.S. --> Spoil bank
Embankment Filter	m^3	5,600	9,700	8,000	Borrow area --> C.S.

Source: JICA Study Team

Table 3.6.3 Summary of Construction Cost

C.S. : Construction Site

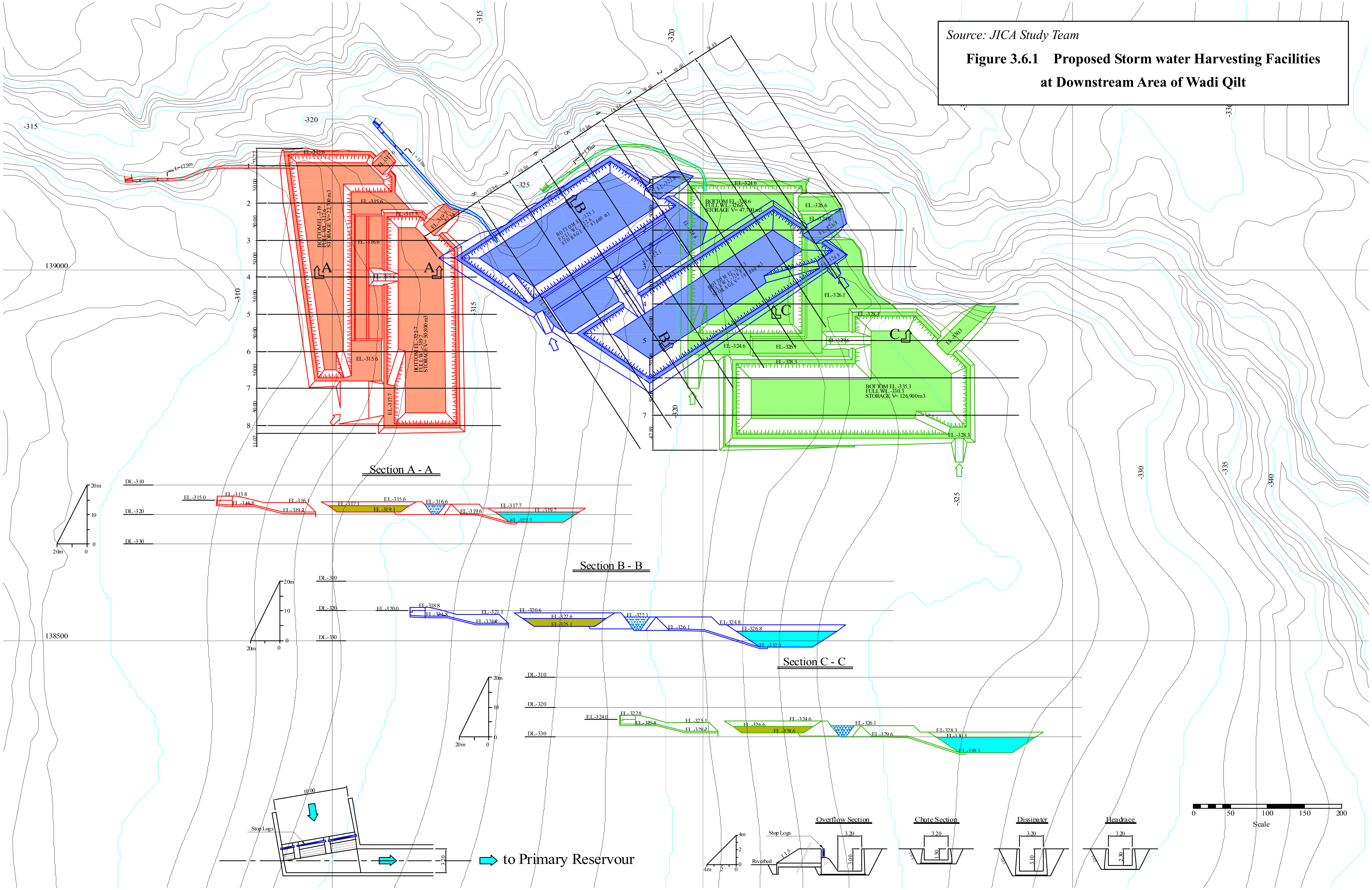
		Unit Cost (USD)	Construction Cost Plan "A"	Plan "B"	Plan "C"	Remarks
Earth Works						
Excavation	m^3	6.0	2,397,000	3,416,400	4,402,200	C.S. --> Spoil bank
Excavation	m^3	6.0		4,800		C.S. --> Stockyard
Embankment	m^3	6.6	---	5,280	---	Stockyard --> C.S.
Rock	m^3	27.5	398,750	654,500	558,250	Borrow area --> C.S.
Filter	m^3	27.5	154,000	266,750	220,000	Borrow area --> C.S.
Slope protectior	m^3	91.8	1,891,080	2,616,300	2,597,940	Wire Mat t=1m
Intake Facility						Including Headrace
Excavation	m^3	6.0	16,800	17,400	16,800	C.S. --> Spoil bank
Excavation	m^3	6.0	10,800	10,800	10,200	C.S. --> Stockyard
Backfill	m^3	12.1	21,780	21,780	20,570	Stockyard --> C.S.
Concrete	m^3	298.3	283,366	289,332	277,400	21N-8-25 RC
Weir Structure						
Concrete	m^3	298.3		173,599		21N-8-25 RC
Excavation	m^3	6.0		55,200		C.S. --> Spoil bank
Backfill	m^3	12.1		12,100		Stockyard --> C.S.
Protection	m^3	91.8		215,730		Gabion
Gate	Nos	200,000		800,000		B*H=4m*2m
Countermeasure for Evaporation from 2nd Reservoir	m^2	12.4	200,222	254,738	312,228	Target covered area 80%
Total Construction Cost (USD)			6,630,427	8,814,709	9,672,217	
Cost for 1 m^3 of water (USD)			129	82	76	Secondary Reservoir
Maintenance Cost						once / ? year
Excavation	m^3	6.0	33,600	58,200	48,000	
Embankment	m^3	27.5	154,000	266,750	220,000	
Total			187,600	324,950	268,000	

Note : All of the cost shown above means "Direct Cost".
All of the cost has reserched in Ramallah except the fuel.
In the case Jericho, an additional cost for transportation or accomodation fee for labor, etc, should be necessary.

Source: JICA Study Team

Source: JICA Study Team

Figure 3.6.1 Proposed Storm water Harvesting Facilities at Downstream Area of Wadi Qilt



Source: *JICA Study Team*

Figure 3.6.2 Basic Concept of Concrete Weir with Gate at Downstream Area of Wadi Qilt

BASIC CONCEPT OF WEIR STRUCTURE

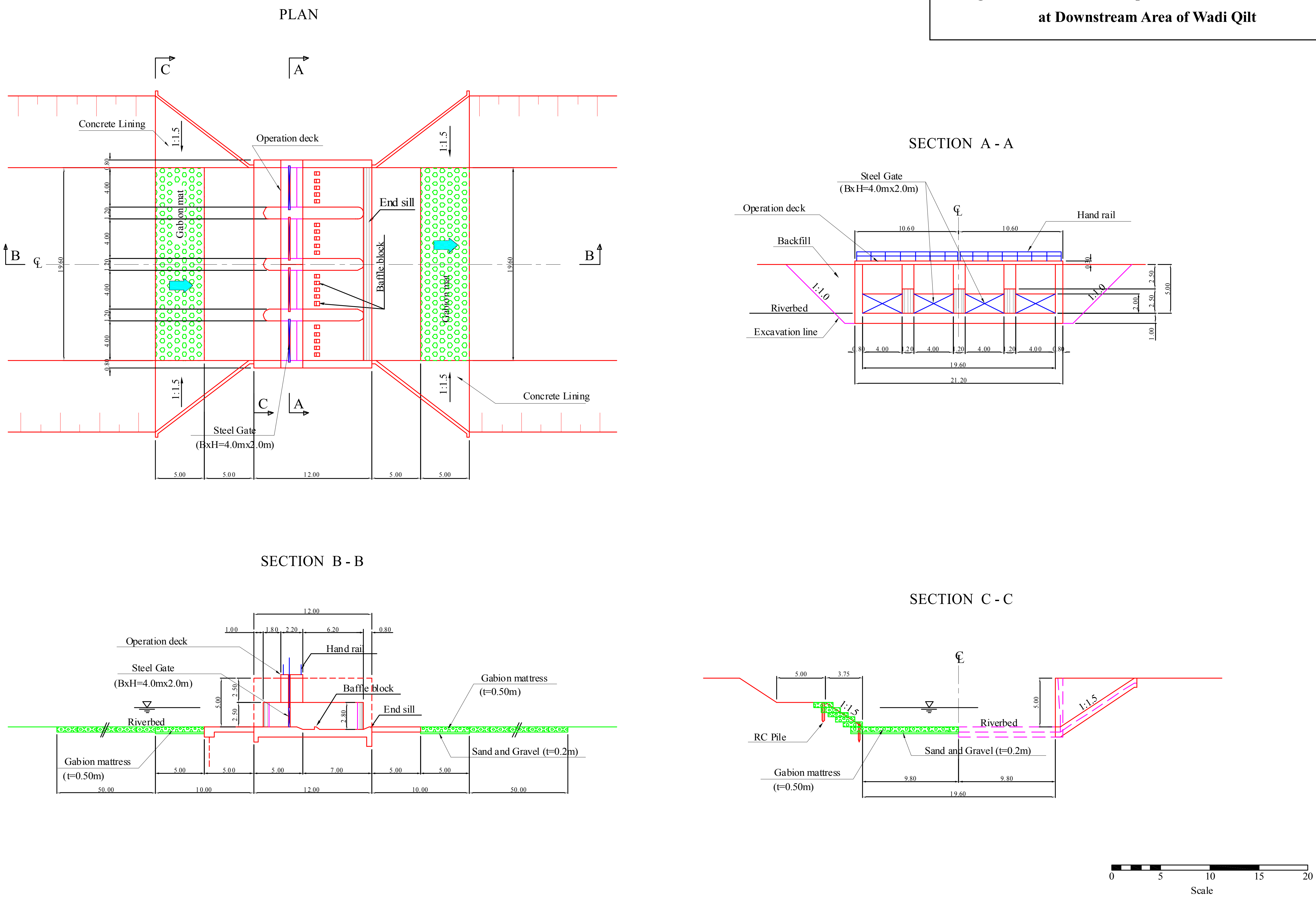


Table 3.6.4 Quantity Calculation of Excavation

D/S Area og Wadi Qilt

EXCAVATION

Sta. NO.	PLAN "**A**"				PLAN "**B**"				PLAN "**C**"			
	L (m)	A (m^2)	A_{ave} (m^2)	V (m^3)	L (m)	A (m^2)	A_{ave} (m^2)	V (m^3)	L (m)	A (m^2)	A_{ave} (m^2)	V (m^3)
No.1	23.8	733	367	8,723	56.9	231	116	6,572	20.9	982	491	10,262
No.2	50.0	663	698	34,900	50.0	913	572	28,600	50.0	1,130	1,056	52,800
No.3	50.0	1,344	1,004	50,175	50.0	995	954	47,700	50.0	1,420	1,275	63,750
No.4	50.0	1,594	1,469	73,450	50.0	1,424	1,210	60,475	50.0	1,579	1,500	74,975
No.5	50.0	1,474	1,534	76,700	50.0	2,140	1,782	89,100	50.0	2,546	2,063	103,125
No.6	50.0	1,261	1,368	68,375	50.0	2,592	2,366	118,300	50.0	3,647	3,097	154,825
No.7	50.0	885	1,073	53,650	50.0	1,935	2,264	113,175	50.0	3,733	3,690	184,500
No.8	50.0	371	628	31,400	50.0	842	1,389	69,425	47.9		1,867	89,405
	11.0		186	2,041	87.4		421	36,795				
Total				399,413				570,142				733,642

Source: JICA Study Team

Table 3.6.5 Quantity Calculation of Rock and Filter
D/S Area of Wadi Qilt

	Rock			Filter		
Plan "A"	$79.6m^2$ * 170m	13,532		$32.4m^2$ * 170m	5,508	
	$(52.8-14.0)m^2$ * 23.8m	923				
	Total	14,455	m^3	Total	5,508	m^3
Plan "B"	$110.1m^2$ * 200m	22,020		$48.4m^2$ * 200m	9,680	
	$(87.0-18.0)m^2$ * 25.7m	1,773				
	Total	23,793	m^3	Total	9,680	m^3
Plan "C"	$94.3m^2$ * 200m	18,860		$40.0m^2$ * 200m	8,000	
	$(75.9-16.0)m^2$ * 24.0m	1,438				
	Total	20,298	m^3	Total	8,000	m^3

Source: JICA Study Team

Table 3.6.6 Quantity Calculation of Intake Facilities

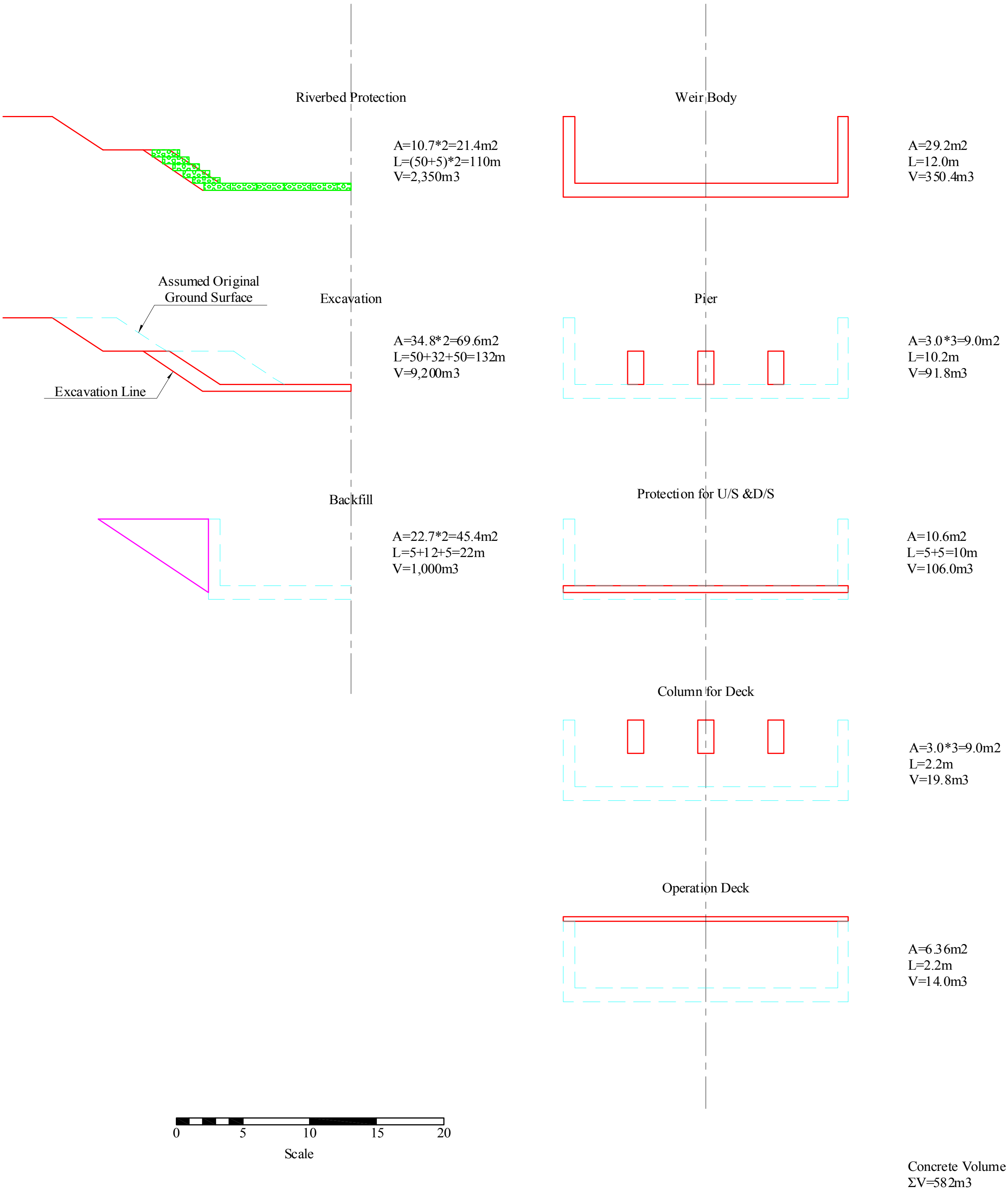
D/S Area og Wadi Qilt

Intake Facilities

			Overflow Section		Transition Section	Steep Chute Section	Stilling Basin	Subtotal	Headrace		
			U/S	D/S					Plan "A"	Plan "B"	Plan "C"
Length		(m)	10.0		10.0	24.0	13.0		175.0	180.0	170.0
Section Area	Concrete	(m^2)	5.7	7.1	4.5	3.3	4.6		4.0		
			Ave. 6.4								
	Excavation	(m^2)	32.5	40.2	24.8	12.8	25.7		18.9		
			Ave. 36.4								
	Backfill	(m^2)	4.8	5.3	10.5	4.5	11.0		7.4		
			Ave. 5.1								
Volume	Concrete	(m^3)	64		45	79	60	248	700	720	680
	Excavation	(m^3)	364		248	307	334	1,253	3,308	3,402	3,213
	Backfill	(m^3)	51		105	108	143	407	1,295	1,332	1,258

Source: JICA Study Team

Figure 3.6.3 Quantity Calculation of Concrete Weir with Gate D/S Area of Wadi Qilt



Source: JICA Study Team

(2) Storm water harvesting facilities at Wadi ‘Auja

Table 3.6.7 Summary of Quantity and Construction Cost
Wadi ‘Auja

【Underground Dam with Rechage Basin】

Item		Quantity	Unit Cost (USD)	Cost (USD)	Remarks
Underground Dam					
Cutt-off Wall (Plan "A")	m^2	10,500	600	6,300,000	Japanese cost is converted into USD
Recharge Basin					
Excavation	m^3	240,000	6.0	1,440,000	200m*200m*Z2m*3Nos. =240,000m^3
Total Cost	USD			7,740,000	**Storage** 300,000 m^3

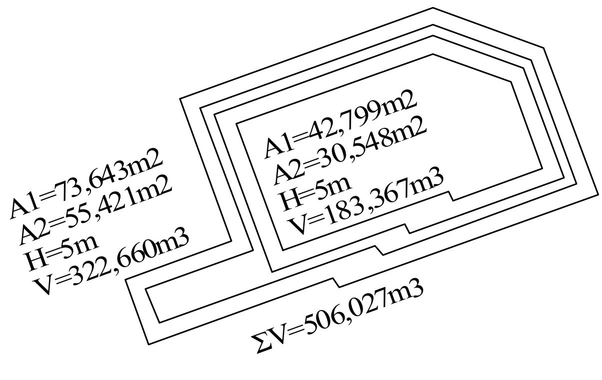
【Regulating Reservoir】

Item		Quantity	Unit Cost (USD)	Cost (USD)	Remarks
Earth Works					
Excavation	m^3	590,000	6.0	3,540,000	Common Soil
Embankment	m^3	---			
Slope protection	m^3	36,300	91.8	3,333,000	t=1m
Countermeasure for evaporation					
Porystyrene-boa	m^2	59,000	12.4	732,000	Target covering area 80% (73,643*0.8)
Total Cost	USD			7,605,000	**Storage** 500,000 m^3

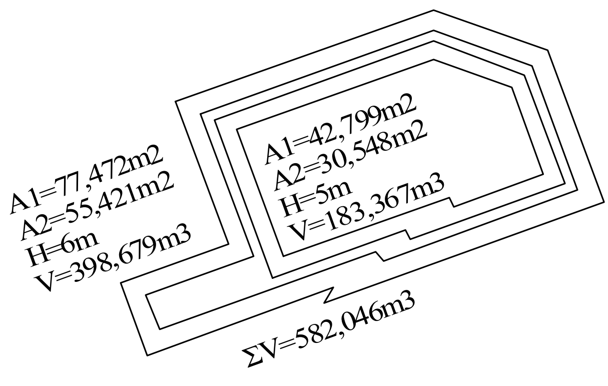
Note : All of the cost shown above means "Direct Cost".
All of the cost has reserched in Ramallah except the fuel.
In the case Jericho, an additional cost for transportation or accomodation for labor, etc, should be necessary.

Source: JICA Study Team

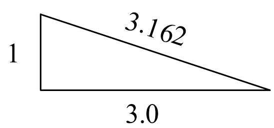
Storage



Excavation Volume



Slope Protection



A=(A1-A2)*(3.162/3.0)
A=(77,472-55,421)*(3.162/3.0)=23,300m2
A=(42,799-30,548)*(3.162/3.0)=13,000m2
Total=36,300m2

Source: JICA Study Team

Figure 3.6.4 Calculation of Storage and Excavation Volume
Regulating Reservoir at Wadi 'Auja

Table 3.6.8 Construction Cost for Slurry Wall/Daaphram Wall

Wadi 'Auja

Mame of Construction Method	Construction Material	Thickness of Wall (m)	Depth (m)	Quantity	Construction Cost (JPY)	Unit Cost per m^2 or m^3 (JPY)	Contractor
MDW	RC	0.7	14.0	3,900 m^2	607,000	156,000	MAEDA corporation
OWS	RC	1.5	56.0	28,000 m^3	2,730,000	98,000	OBAYASHI corporation
SSS-G	RC	1.5	70.0	8,052 m^2	2,137,000	266,000	SHIMIZU corporation
SMW	Soil Cement pile	ϕ0.55	15.0	12,800 m^2	723,000	57,000	SHIMIZU corporation
MTW	Bentonite treatment	0.5	18.0	4,500 m^2	234,000	52,000	MAEDA corporation
SG	SG Treatment	0.5	19.0	4,350 m^2	187,500	44,000	OBAYASHI corporation
Diaphragm Wall with Asphalt Core	Asphalt Concrete	0.5	13.0	1,554 m^3	139,000	90,000	TAISEI ROTEC corporation

Source : Cost Estimation Examples for New Construction Methodology , 2000 (JPN)

Source: JICA Study Team

(3) Pilot Project for Storm water harvesting facilities at Wadi Qilt

Four (4) candidate sites for the pilot project were selected at the D/S area of Wadi Qilt. After selection of proposed site among four, PP2 has selected as a suitable site for the pilot project.

Table 3.6.9 Calculation of Storage for Each Proposed Site of Pilot Project

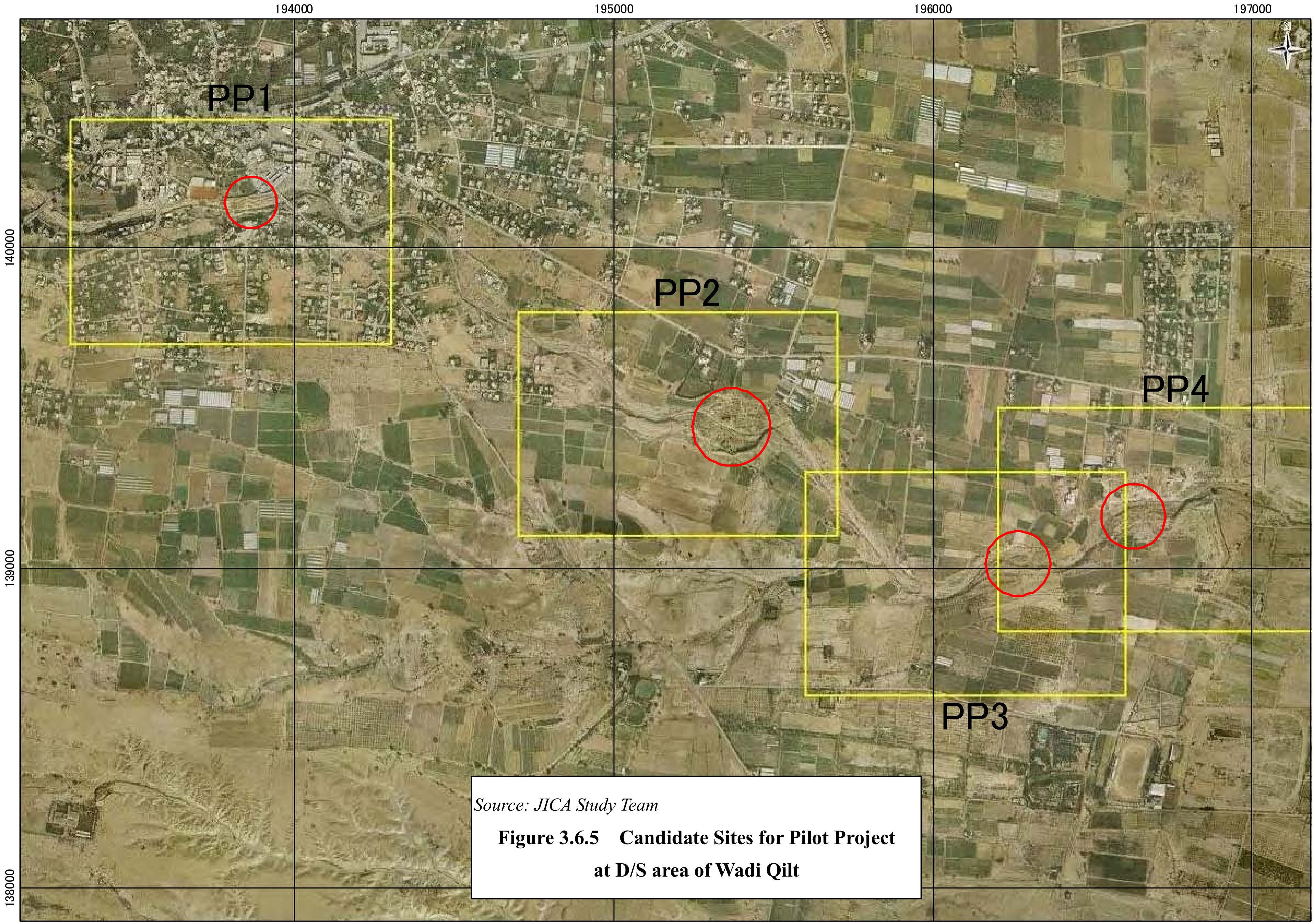
PP1	EL.	ΔH (m)	A (m^2)	Aave (m^2)	V (m^3)
	-273.5		0	0	0
	-271.5	2	1,965	983	1,965
	-269.5	2	2,501	2,233	4,466
					6,431
	Porosity = 0.2				**1,286**

PP2	EL.	ΔH (m)	A (m^2)	Aave (m^2)	V (m^3)
	-297		71	36	0
	-295	2	10,519	5,295	10,590
	-293	2	11,453	10,986	21,972
					32,562
	Porosity = 0.2				**6,512**

PP3	EL.	ΔH (m)	A (m^2)	Aave (m^2)	V (m^3)
	-309		0	0	0
	-307	2	3,742	1,871	3,742
	-305	2	4,554	4,148	8,296
					12,038
	Porosity = 0.2				**2,408**

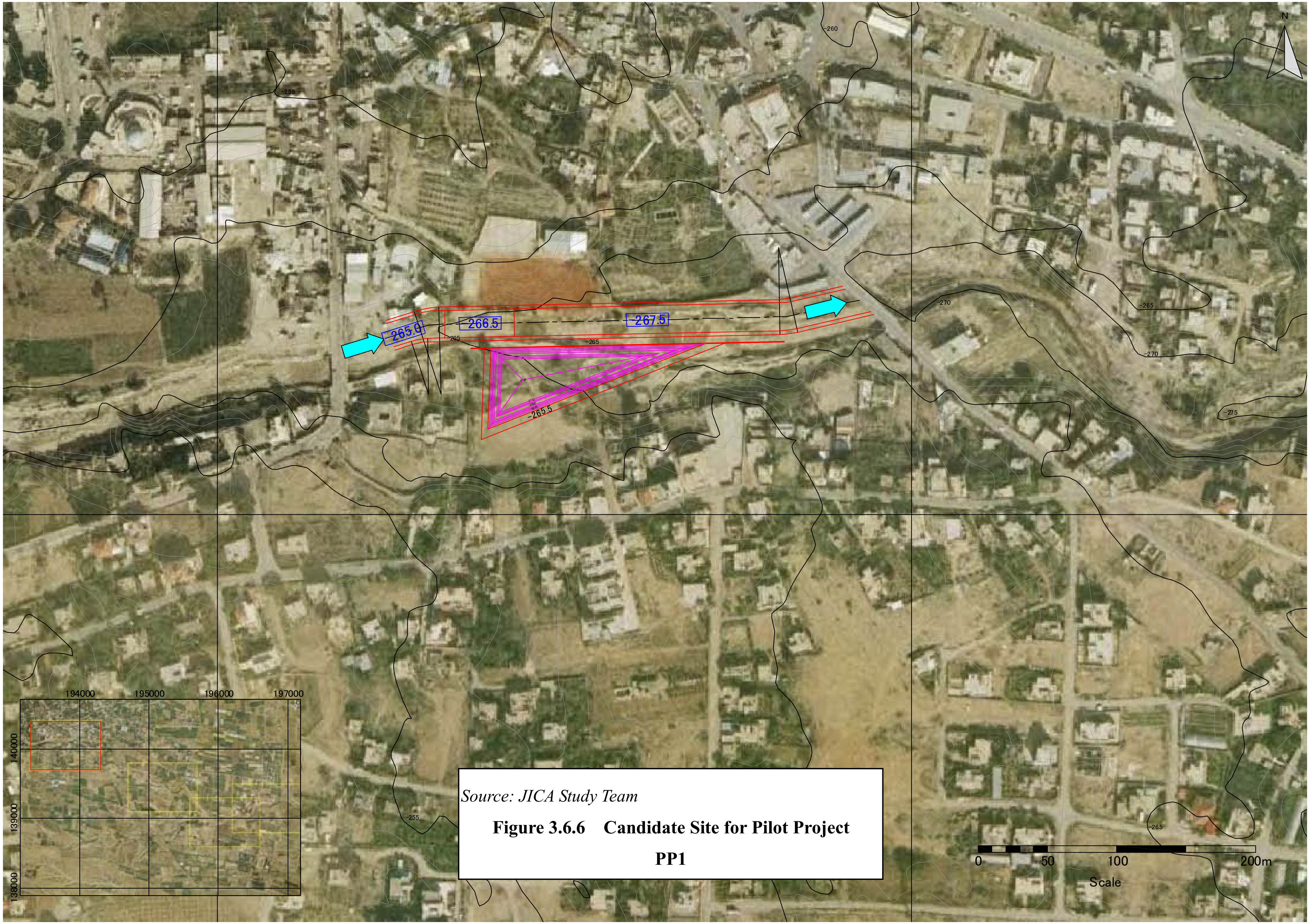
PP4	EL.	ΔH (m)	A (m^2)	Aave (m^2)	V (m^3)
	-296		0	0	0
	-295	1	3,919	1,960	1,960
	-293	2	4,572	4,246	8,491
					10,451
	Porosity = 0.2				**2,090**

Source: JICA Study Team, calculated by CAD



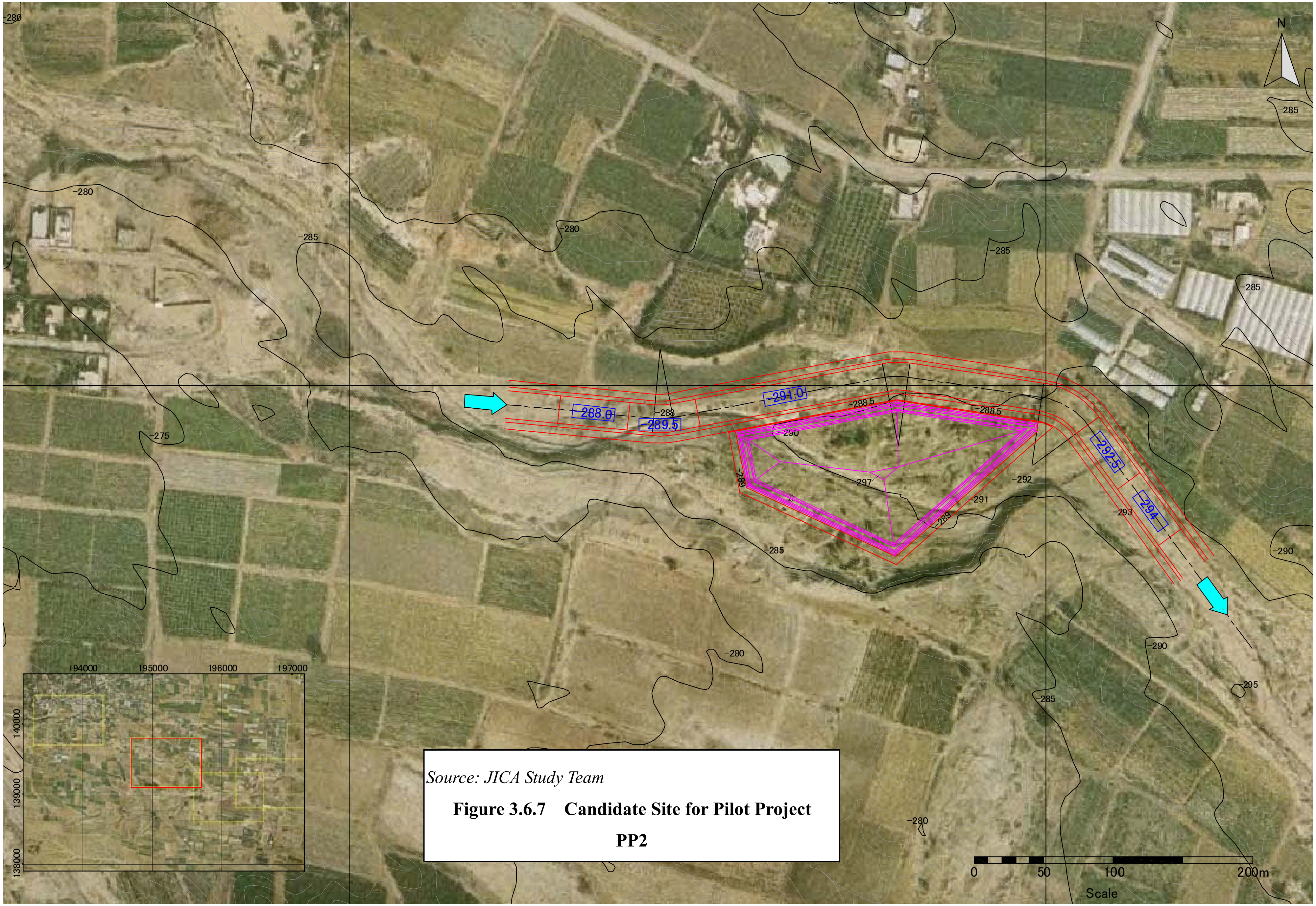
Source: JICA Study Team

Figure 3.6.5 Candidate Sites for Pilot Project at D/S area of Wadi Qilt



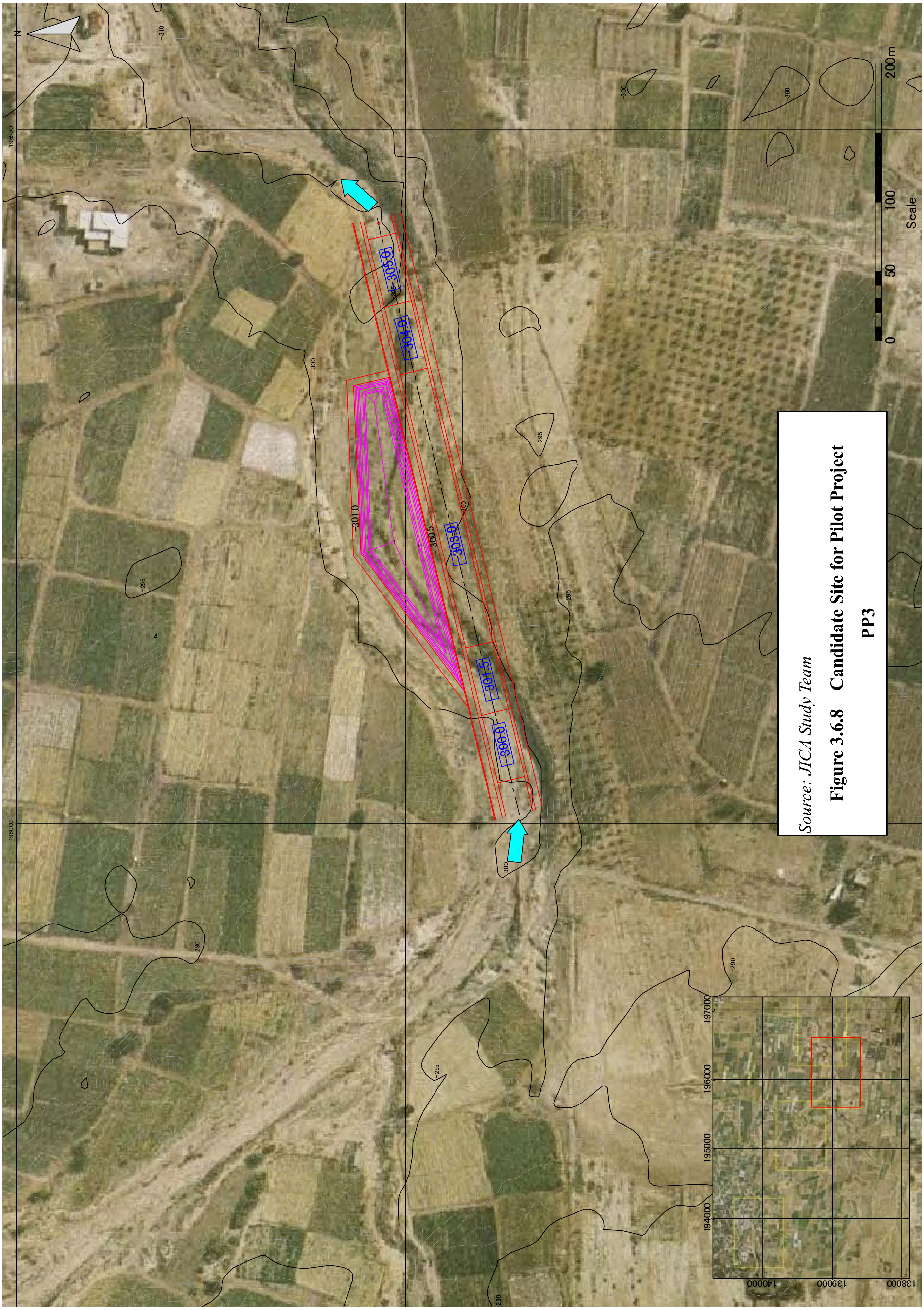
Source: JICA Study Team

Figure 3.6.6 Candidate Site for Pilot Project PP1



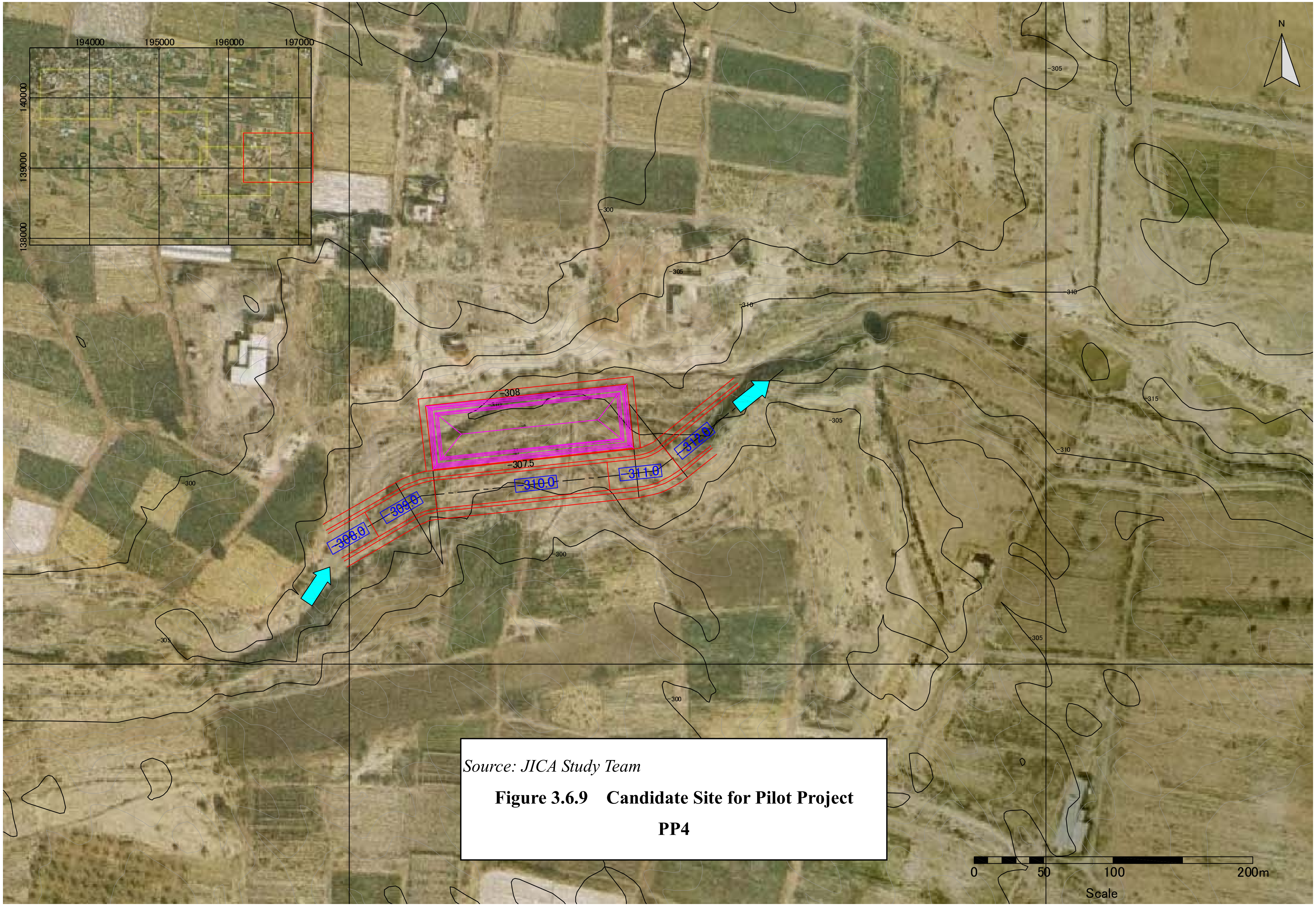
Source: JICA Study Team

Figure 3.6.7 Candidate Site for Pilot Project PP2



Source: JICA Study Team

Figure 3.6.8 Candidate Site for Pilot Project PP3



Source: JICA Study Team

Figure 3.6.9 Candidate Site for Pilot Project PP4

Table 3.6.10 Quantity Calculation

PP2

Excavation

STA.	Dist. (m)	Area (m^2)	Ave. (m^2)	Vol. (m^3)
0	50	28	14.0	700
100	100	102	65.0	6,500
221	121	586	344.0	41,624
335	114	32	309.0	35,226
375	40	3	17.5	700
475	100	47	25.0	2,500
	50		23.5	1,175
			Total	**88,425**

Filter

(4+16)/2*6*50 3000 m^3

Well screen

20*5*3 300 m

Infiltraton Gallery

30*3

2*5*3 120 m

Well / Pump

2 Nos

Embank (L/R Bank)

STA.	Dist. (m)	Area (m^2)	Ave. (m^2)	Vol. (m^3)
0	50	19	9.5	475
100	100		9.5	950
221	121	20	10.0	1,210
335	114	72	46.0	5,244
375	40	36	54.0	2,160
475	100	9	22.5	2,250
	50		4.5	225
			Total	**12,514**

Embank (Rock)

STA.	Dist. (m)	Area (m^2)	Ave. (m^2)	Vol. (m^3)
0	50		0.0	0
100	100		0.0	0
221	121	345	172.5	20,873
335	114		172.5	19,665
375	40		0.0	0
475	100		0.0	0
	50		0.0	0
			Total	**40,538**

Embank (Gabion)

STA.	Dist. (m)	Area (m^2)	Ave. (m^2)	Vol. (m^3)
0	50	21	10.5	525
100	100	21	21.0	2,100
221	121	21	21.0	2,541
335	114	21	21.0	2,394
375	40	21	21.0	840
475	100	21	21.0	2,100
	50		10.5	525
			Total	**11,025**

Embank (Backfill)

STA.	Dist. (m)	Area (m^2)	Ave. (m^2)	Vol. (m^3)
0	50		0.0	0
100	100		0.0	0
221	121	291	145.5	17,606
335	114		145.5	16,587
375	40		0.0	0
475	100		0.0	0
	50		0.0	0
			Total	**34,193**

Source: JICA Study Team

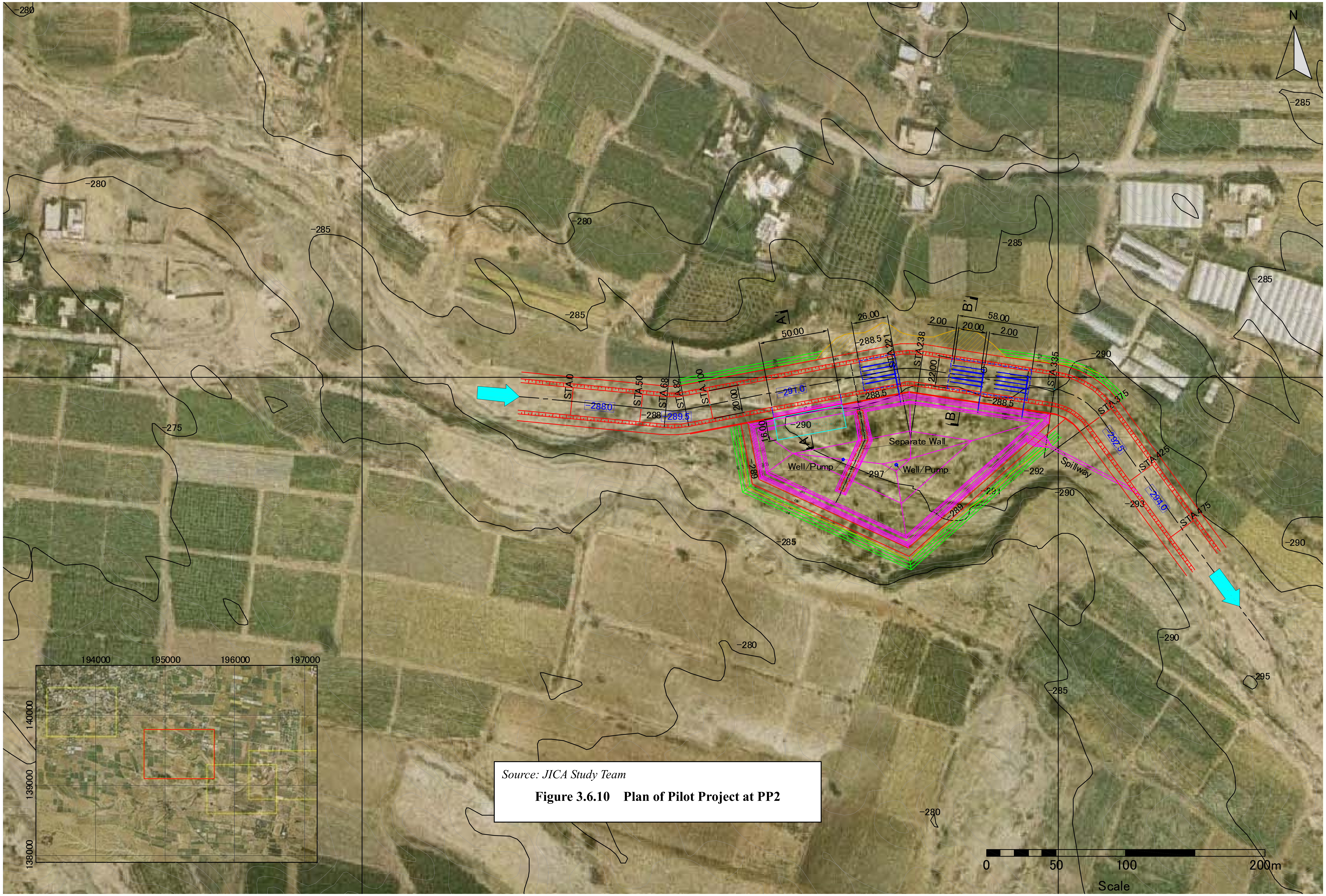
Table 3.6.11 Summary of Quantity and Construction Cost
PP2

C.S. : Construction Site

Item	Specification	Unit	Quantity	Unit Cost (USD)	Cost (USD)	Remarks
Earth Works						
Excavation	Common Soil	m^3	88,425			
		m^3	41,719	6.0	250,311	C.S. --> Spoil bank
		m^3	46,707	6.0	280,239	C.S. --> Stockyard
Embankment	Common Soil	m^3	46,707	6.6	308,263	Stockyard --> C.S.
	Rock	m^3	40,538	27.5	1,114,795	
	Filter	m^3	3,000	27.5	82,500	
Gabion	Rock	m^3	11,025	27.5	303,188	
	Wire mat	nos	11,025	50.0	551,250	
Intake Facility						
Well / Pump	2 nos	LS	1		20,000	
Well screen	ϕ300	m	110	110.0	12,100	
Infiltration gallery	ϕ300	m^3	80	120.0	9,600	
Total Construction Cost (USD)					2,932,245	

Note : All of the cost shown above means "Direct Cost".
All of the cost reserch except the fuel has made in Ramallah.
In the case Jericho, an additional cost for transportation or accomodation fee for labor, etc, should be necessary.

Source: JICA Study Team



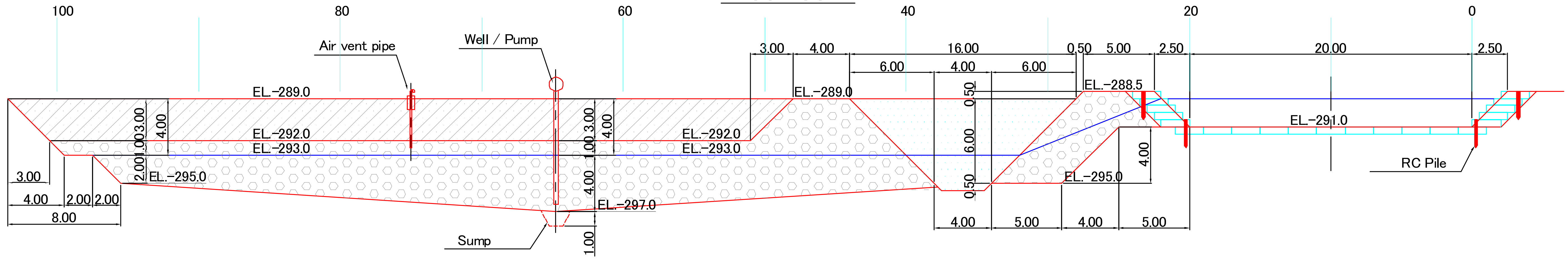
Source: JICA Study Team

Figure 3.6.10 Plan of Pilot Project at PP2

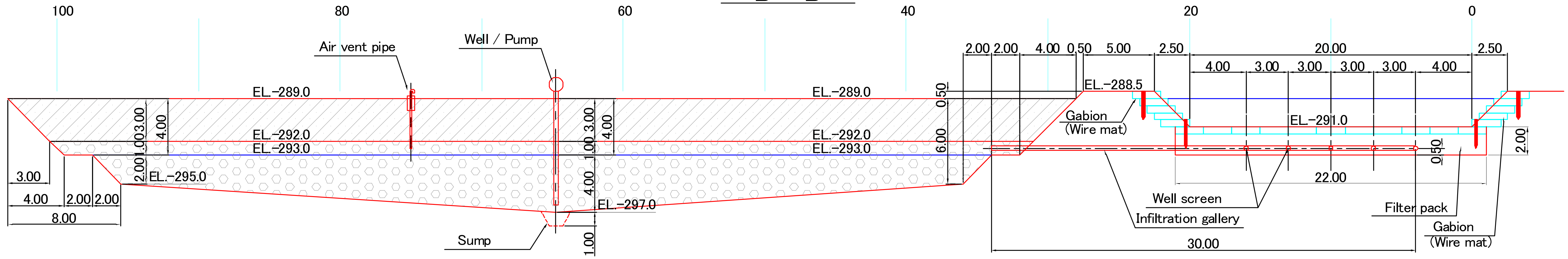
Source: JICA Study Team

Figure 3.6.11 Standard Cross Section and Profile of Pilot Project at PP2

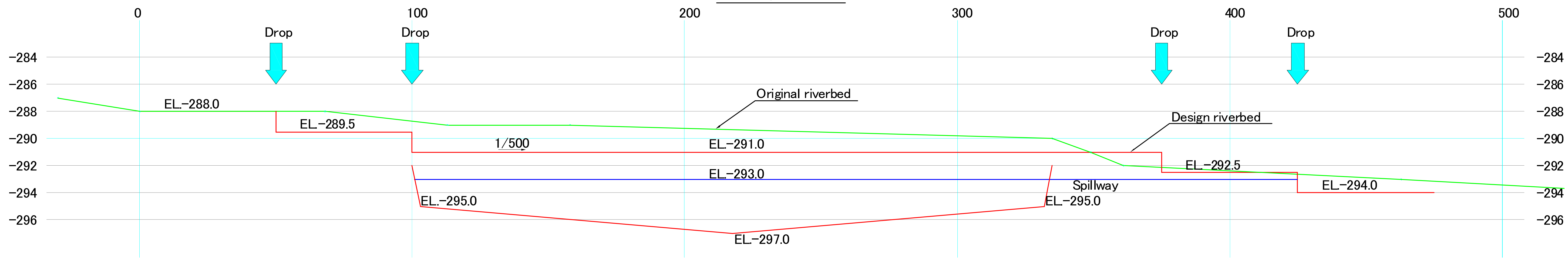
A – A'



B – B'



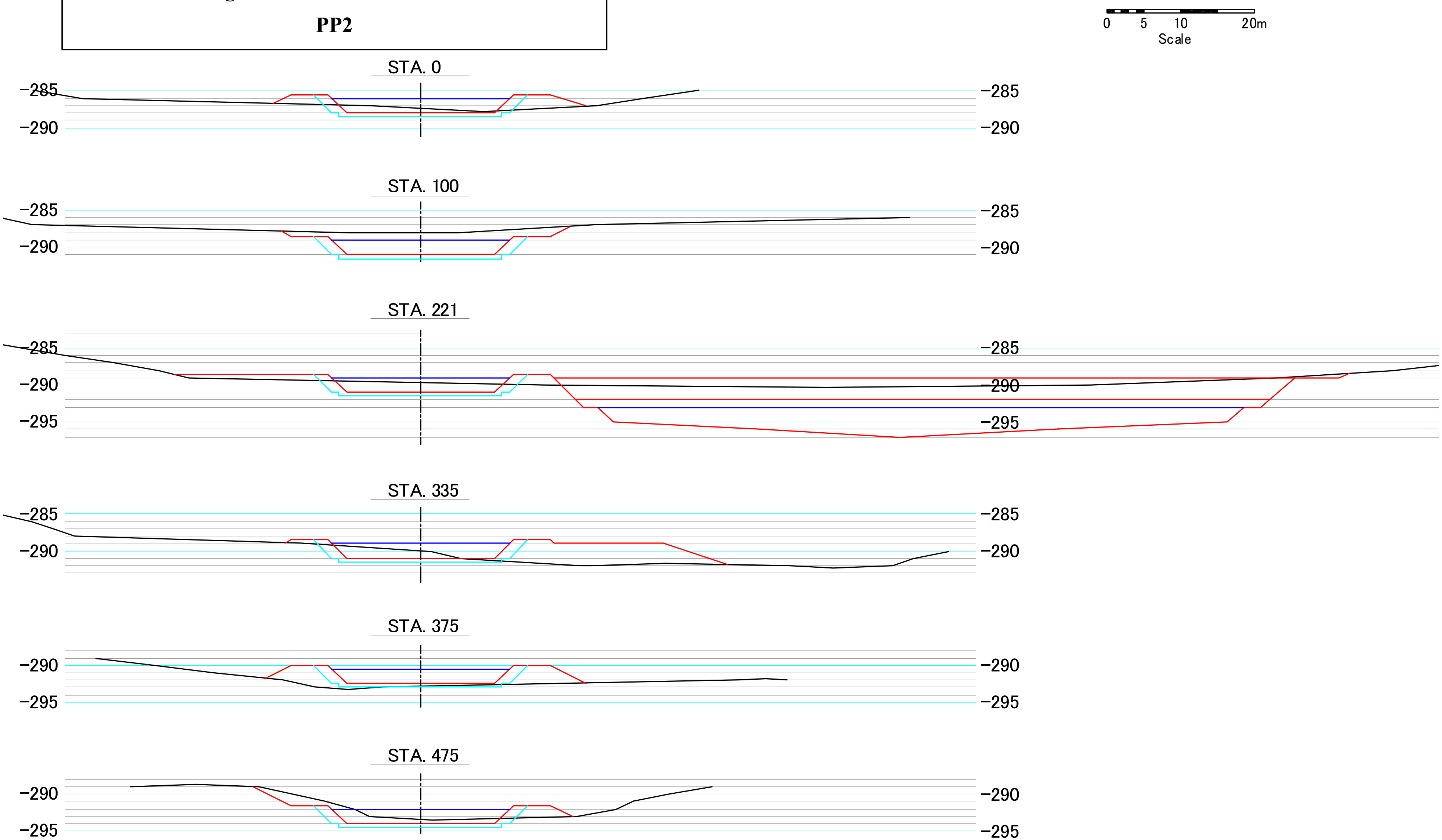
PROFILE



Source: JICA Study Team

Figure 3.6.12 Cros Section

PP2



Annex 3.7

Consideration on Intake Facility

Annex 3.7 Consideration on Intake Facility

The intake methodology from the wadi is one of the most difficult skills to be examined. It is suggested to construct the storm water harvesting facilities which consist of the intake facilities and reservoir located outside on the wadi bank is recommended in the downstream area of Wadi Qilt. The following alternative facilities are conceivable as the intake facilities and water conveyance facilities to convey the diverted flood water of the wadi to the primary reservoir by the headrace:

Alt.-1; To provide diversion weir on the wadi and headrace channel to connect the wadi channel and primary reservoir

Alt.-2; To provide diversion intake weir and install mobile pump facilities loaded on trucks that are used to pump up wadi stream flow on a sum pit and transfer it into the primary reservoir

Alt.-3; To provide infiltration gallery in the wadi bed and pump(s) installed in sum pit

For the time being, it is proposed to adopt Alt.-1, namely to construct a concrete weir with gate on the river channel in order to regulate flood flow and divert excessive flow downstream. The intake facility consists of an over-flow weir, a side channel and a headrace. The turbid water at the initial flood stage will be diverted downstream through the gate. When the level of flow and turbidity becomes suitable, the gate will be closed to secure the water at a depth of 1 - 1.5 m. Simultaneously, the flow volume is also diverted by controlling a stop log installed at the top of the over-flow weir. In case of Alt.-1, the process of storing flood water is conducted by the gravity.

Use of mobile pump facilities loaded on trucks (Alt.-2) is also a possible alternative method in constructing the over-flow weir and side channel (Refer to Figure 3.7.1). Specification and price information of a typical pumping car as of now is as follows:

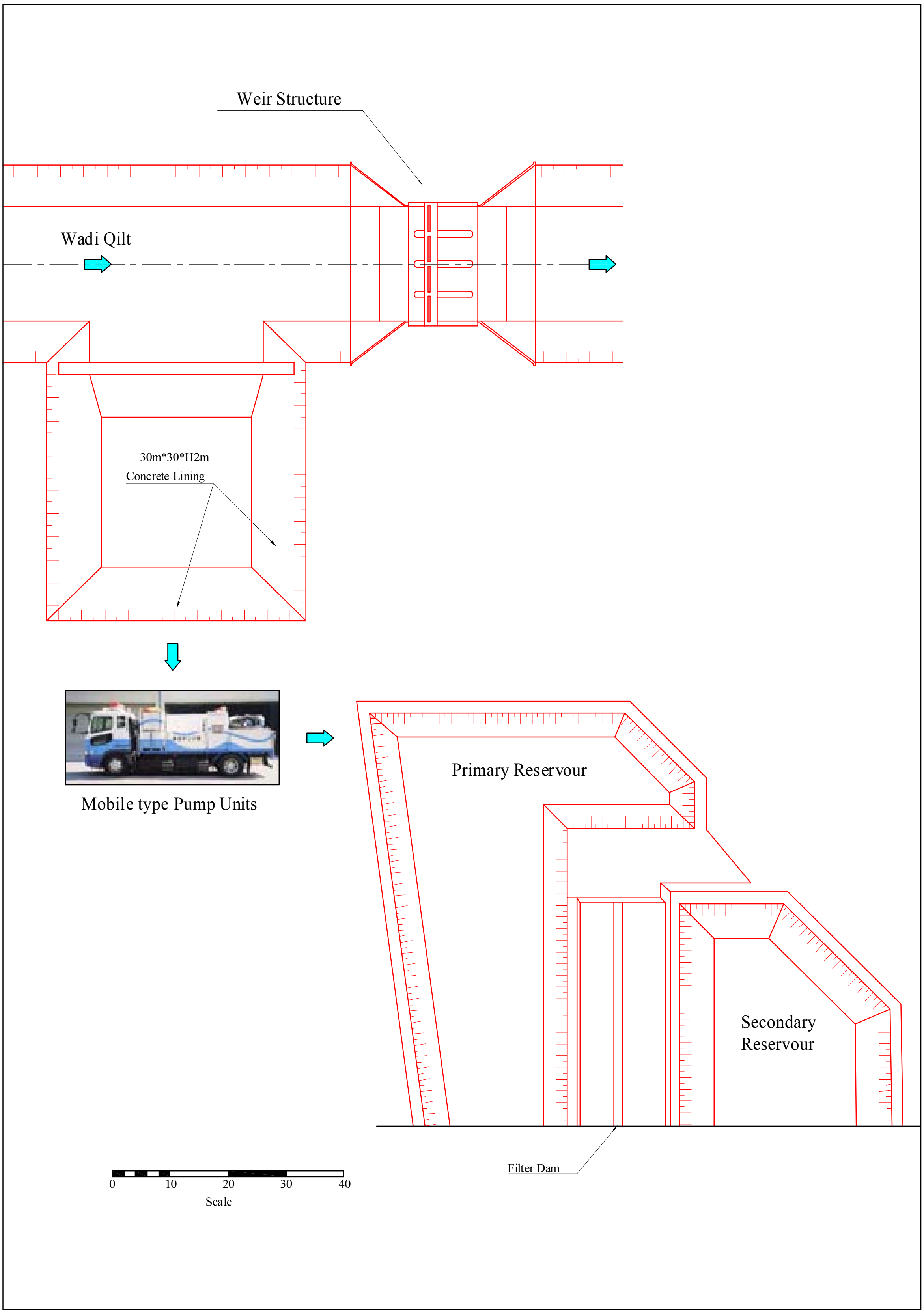
- Pumping capacity *Q=1m3/sec (60m^3/min)*
- Price JPY.55,000,000 (USD.509,000)

http://www.fukui-moc.go.jp/bousai/kikai/b_haisui.html

http://www.pref.tokushima.jp/governor.nsf/tx_kaiken?openagent&id=6BEB401682A95A24492570C30037CBAB&p=0

Alt.-3 is selected as the water harvesting plan for the pilot project in the next stage after completion of this Study as described in the foregoing Subsection 6.4.9. For the time being, in addition, it is envisaged that the priority plan of storm water harvesting for the feasibility study, which is expected to be carried out after the pilot project, be selected among from the above three (3) alternative plans.

Figure 3.7.1 Intake method using the pumping car



Source: JICA Study Team

Annex 3.8

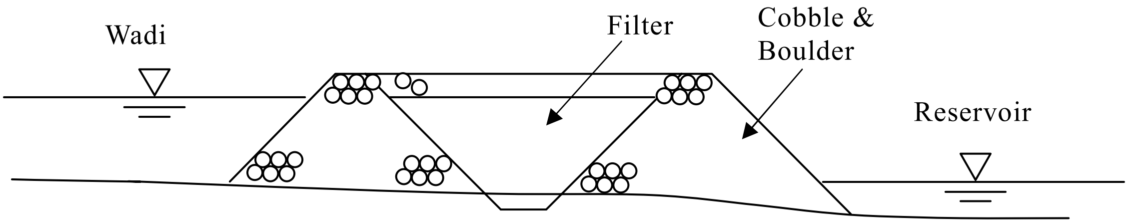
Intake Capacity of Filter Dam and Infiltration Gallery for Pilot Project

Annex 3.8 Intake Capacity of Filter Dam and Infiltration Gallery for Pilot Project

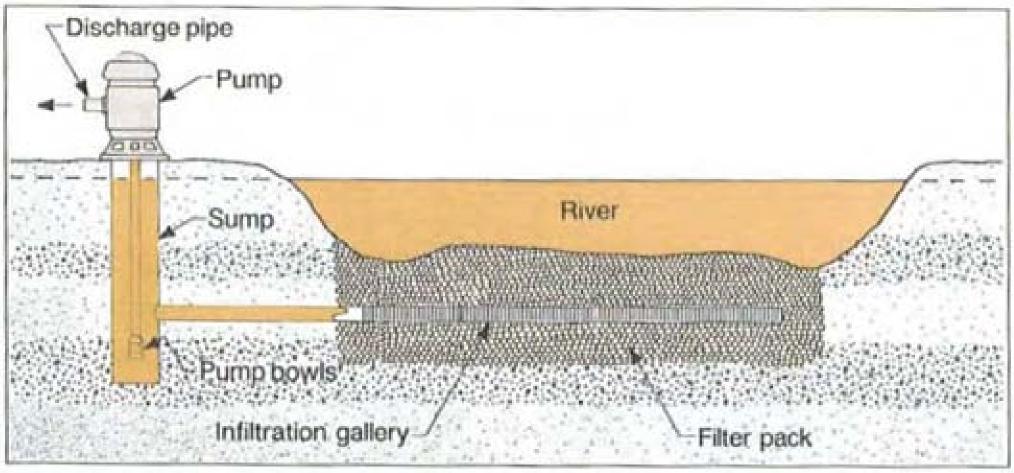
(1) Water intake plan

A preliminary design for taking water from Wadi-river via filter dam and infiltration gallery is prepared for the Pilot Project.

- Filter Dam



- Infiltration Gallery



Source:Todd, Groundwater and Wells 2^{nd} ed, Wiley, 2000

Figure 3.8.1 Proposed intake plan for Pilot Project

(2) Water storage plan

Reservoir should be constructed along with the intake point of Wadi-river. Following matters are to be considered;

- Reservoir will be excavated by open-cut, and the elevation of the reservoir bottom shall be set below the Wadi-riverbed. An excavating depth of 10m is required. Under the circumstance, if the open-cut reservoir were left for a long period, it would be very difficult to cope with a flooding problem and slope failure that endanger the safety protection of Wadi-river and its surroundings.
- Therefore, it is planned that the water is impounded among the cobbles that are backfilled in the reservoir. The excavated materials shall be backfilled at the top of the cobbles up to the same elevation of the original ground.
- Filter dam and infiltration gallery shall be structured separately.

- Intake water volume cannot be adjusted by the proposed intake method. Therefore, it is required to construct a facility (spillway) which can safely release the water beyond the reservoir's storage capacity if unexpected volume of water inflowed into the reservoir.
- The stored water is pumped up by a pumping well that is installed inside the reservoir.

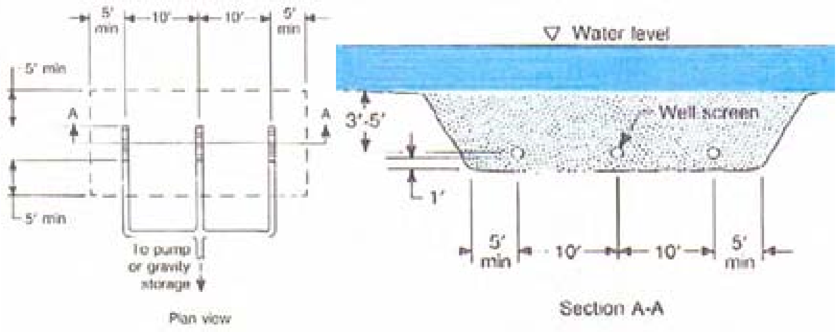
(3) Estimation of the intake quantity by Infiltration Gallery

Based upon the foregoing discussions, a preliminary design regarding the candidate no.2 (PP2) for the pilot project has been undertaken. Water intake quantity is calculated based upon the typical four formulae shown below. The respective calculation results are summarized in Figure 3.8.2.

Formula-1　Groundwater and Wells

$$L = \frac{0.366\, Q \log\left(\frac{1.1\, d}{r}\right)}{0.25\, K\, H} \qquad (22.9)$$

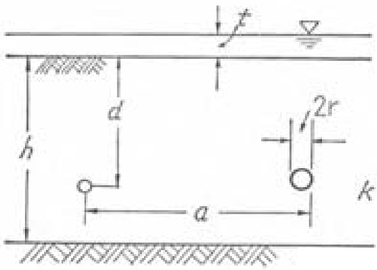
where
the width of the trench is approximately equal to 2 times the burial depth, d, that is, the distance between the bottom of the stream and the center of the screen, in m; and
L = length of the infiltration screen, in m
K = hydraulic conductivity of the filter pack material, in m/day
H = submergence of infiltration screen, that is, the distance between the stream surface and the center of the screen (available head), in m



Formula-2　Design Criteria for Land Improvement Projects (Japanese)

$$a/h \geqq 1 \quad Q = \frac{2\pi K(t+d-r)}{\ln\left\{\left[\tan\frac{\pi(2d-r)}{4h}\right]\left[\cot\frac{\pi r}{4h}\right]\right\}} \cdots\cdots$$

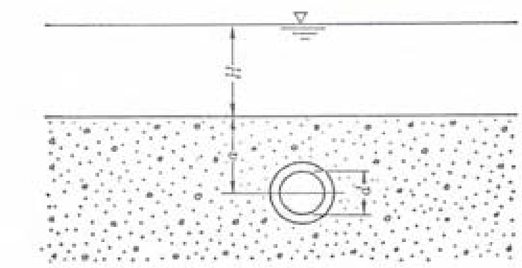
$$a/h < 1 \quad Q = \frac{2\pi K(t+d-r)}{\ln\left\{\left[\sinh\frac{\pi(2d-r)}{a}\right]\left[\mathrm{cosech}\frac{\pi r}{a}\right]\right\}} \cdots$$



Formula-3　Agricultural Engineering Handbook (Japanese)

$$q = \frac{2\pi k\{H+a-(F/W_0)\}}{2.3\log10(4a/d)}$$

q: Inflow Discharge (m^3/s)
d: Diameter (m)
H: Water Depth (m)
a: Depth from Riverbed (m)
P_0: Hydraulic Pressure (t/m^2)
w_0: Unit Weight (t/m^3)



Formula-4　Hydraulics Formulas (Japanese)

$$Q_{UD} = \frac{2\pi k\{H_0+d-(p_c/w)\}\cdot l}{2.3\log_{10}\left\{\dfrac{\sin Na+\sin N(d-r)}{\sin Na-\sin N(d-r)}\right\}}$$

$$N = (\pi/2)/I,\ a = \frac{2I}{\pi}\sin^{-1}\sqrt{\sin N(d-r)\cdot\sin(d-r)} \fallingdotseq d$$

$$I \to \infty \qquad Q = \frac{2\pi k\{H_0+d-(p_c/w)\}\cdot l}{2.3\log_{10}\{(d+\sqrt{d^2-r^2})/r\}}$$

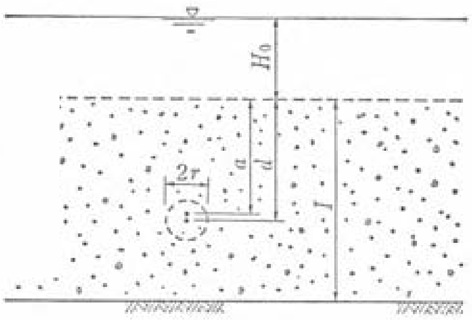
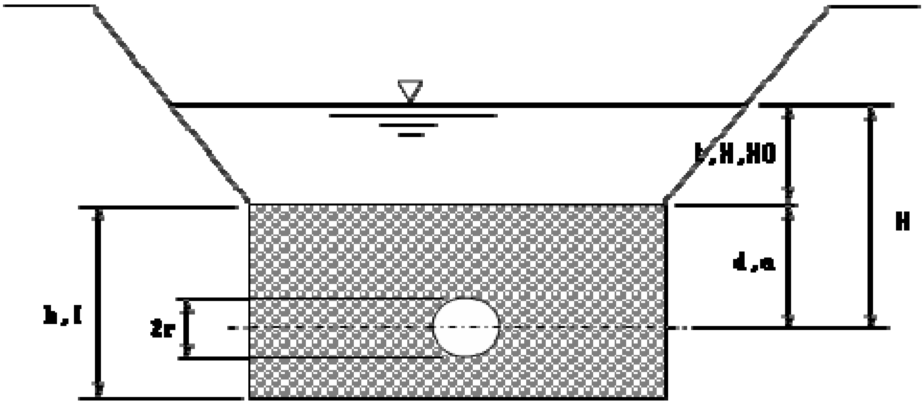


Figure 3.8.2　Typical Formulae for Water Intake Quantity

Table 3.8.1 Intake Quantity from the Infiltration Gallery



	Form. 1	Form. 2	Form. 3	Form. 4	Design Value
Water Depth (m)		t	H	H0	0.3
Depth between Riverbed and Pipe (m)	d	d	a	d=a	1.5
Water Surface to Pipe (m)	H				1.8
Riverbed to Impervious Layer (m)		h		I	2
Radius of Infiltration Gallery (m)	r	r	d	r	0.15
Permeability Coefficient (m/day)	K	k	k	k	8.64
Pressure in Pipe(t/m^2)			P0		0
Unit Weight of Water(t/m^3)			w0		1
Intake Quantity (m^3/day/m)	10.20	25.20	26.49	40.15	

It is assumed that the water depth of the Wadi-river is 30cm, and the coefficient of permeability of the gravel layer surrounding the infiltration gallery is $k = 1x10^{-2} cm/sec$ (=8.64m/day). Based upon the above assumption, the available intake quantity is estimated at about 3,000 m^3 per day in the case the "Formula-1" is employed.

$$Q = 10.2(m^3/day/m) \; x \; 20(m) \; x \; 5(nos.) \; x \; 3(sets) = 3,060(m^3/day)$$

Length of the pipe in the infiltration gallery	20m
Installation of pipes in the section	5 pipes
Spot of the section	3 spots

(4) Estimation of water intake quantity by Filter Dam

In turn, the intake quantity permeated the filter dam is also calculated based upon the following conditions:

Permeability coefficient	$k = 1x10^{-2} cm/sec$ (=8.64m/day)
Extension of filter	50m
Width of filter	$L = 4m$
Peak height and bottom height	$H = 2.3m$, $h = 0m$ (Refer to Figure 3.8.3)

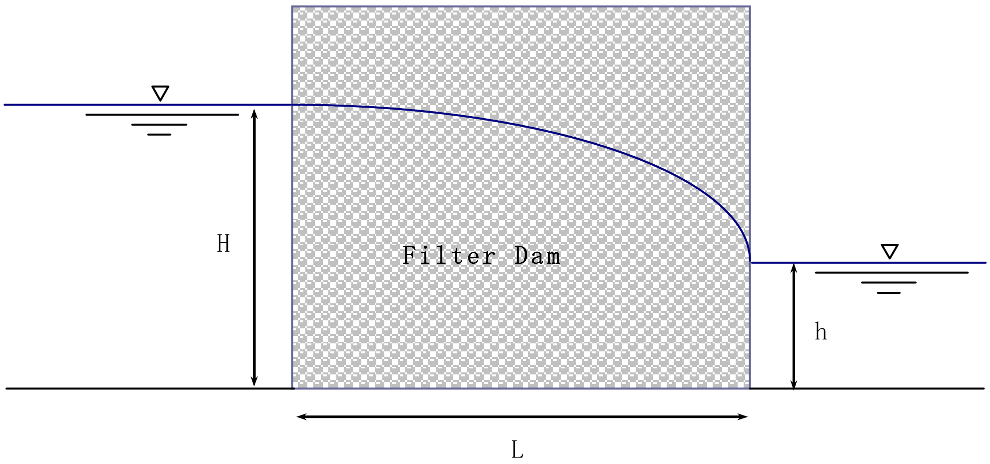


Figure 3.8.3 Filter Dam Model

$Q = k \times (H - h) / 2L \quad (m^3/day/m)$

$Q = 8.64 \times (2.3) / (2 \times 4) \times 50 = 120 \ (m^3/day)$

(5) Possible intake quantity and storage capacity

Finally, the possible intake quantity is estimated at about 3,100 m^3 per day by summing up the twofold estimation results, about 3,000m^3/day for infiltration gallery and 100m^3/day for the filter dam. On the other hand, the storage capacity of the reservoir is designed at 6,500 m^3, and consequently the intake quantity may fulfill the reservoir in two days. Since the flood water is ordinarily running for a couple of days continuously, the reservoir would be filled with by single flood. The operation and management of the reservoir has to be well considered those hydrologic conditions.

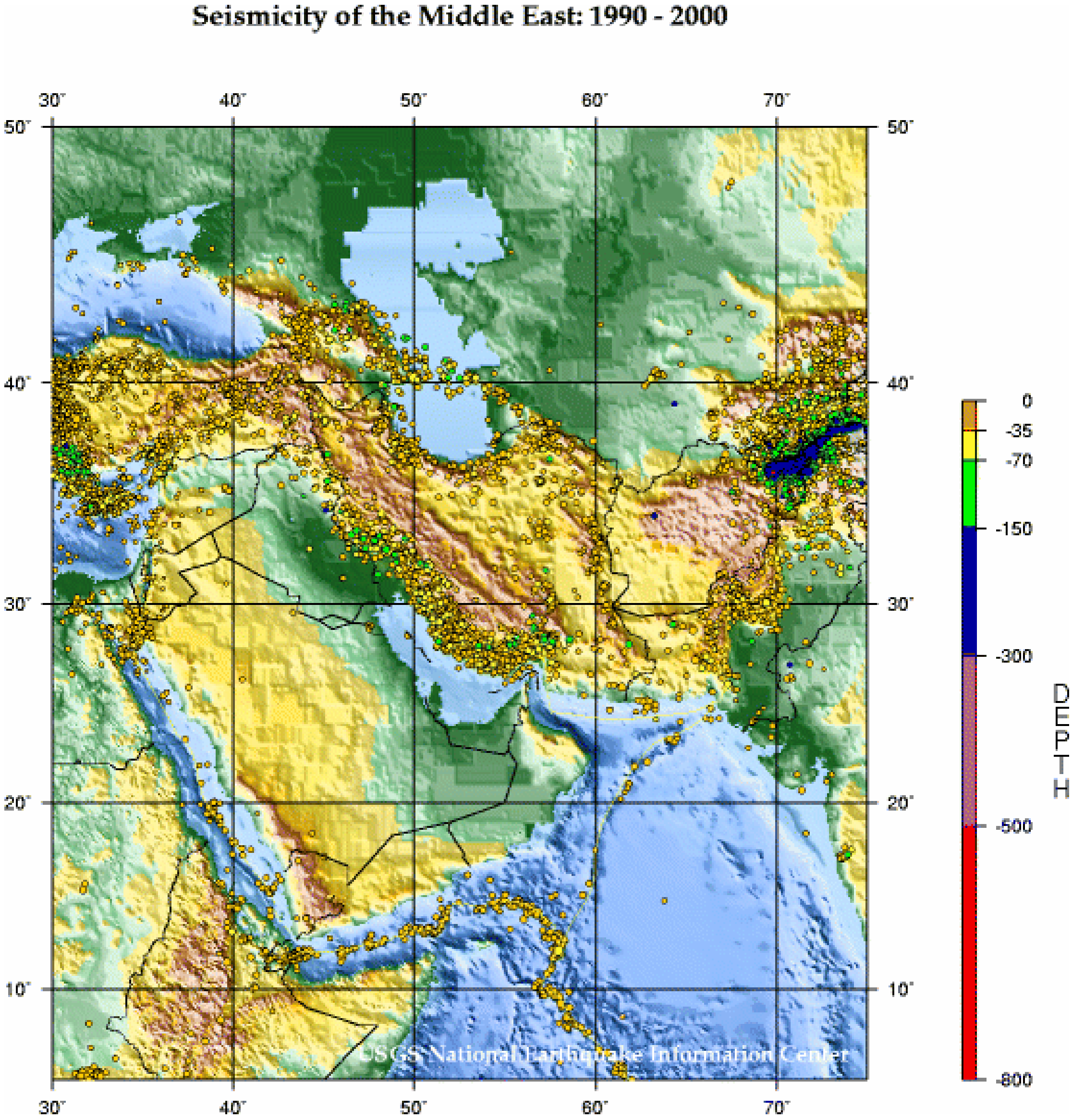
Annex 3.9

Seismicity

Annex 3.9 Seismicity

Design seismic force should be determined as a fundamental design condition. Seismicity around middle-east area including Jericho, Palestine is studied through the internet so as to grasp the necessity of taking seismic force into design of each structure, and to obtain rough seismic intensity.

Figure 3.9.1 shows distribution of epicenter which had been taken place during 10 years from 1990 to 2000. As shown in this figure, earthquakes have been taken place in Palestine even though distribution of epicenter does not concentrate in Palestine.



http://earthquake.usgs.gov/regional/world/seismicity/m_east.php

Figure 3.9.1 Seismicity around Middle-East Area

Japanese formula is applied to estimate maximum acceleration cased by earthquake as a primary approach. After statistical calculation, it is recognized that seismic force should be taken into design of the water harvesting facility. According to the statistical study of seismicity around Jericho, design seismic force of Kh = 0.2 is recommended as a 100 years return period seismic force. (Further investigation shall be required.)

Prediction of seismic intensity around Jericho

Calculation conditions

Location of Jericho :	Latitude :	31.8
	Longitude :	35.5
Duration of Observation :	28 yrs (1979-2007)	
Numbers of Earthquake :	54 (M>3)	
Formula :	Tamura and Okamoto	
	Ministry of Construction (MOC)	

Calculation Result

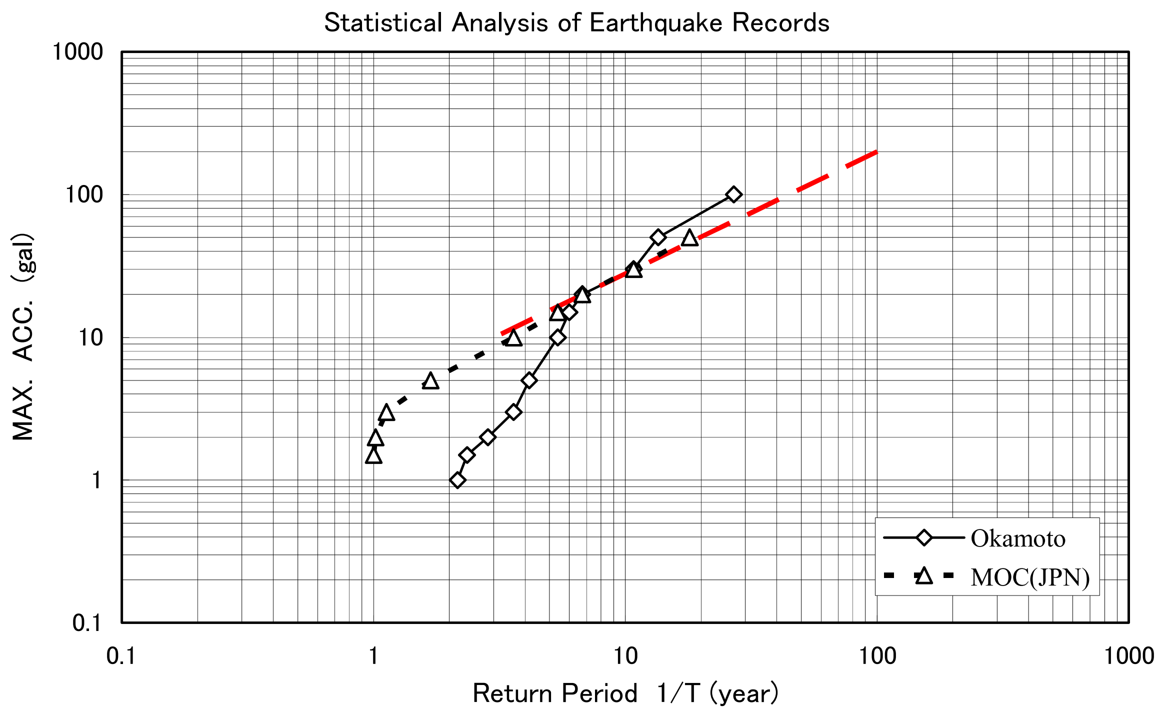


Figure 3.9.2 Statistical Analysis of Earthquake Records

(Based on the data from NEIC, National Earthquake Information Center)

Table 3.9.1

SEISMIC ANALISYS AROUND JERICHO

Location of Jericho	31.8 N 35.5 E	Radius of Earth Distance of 1 deg.	6370 km 111.2 km

SN	Date	Epicenter		Depth	Mag.	Epicentral Distance	Probable Maximum Acceleration Amax (gal)		Remarks
							Tamura & Okamoto	MOC (JPN)	
		Lat.	Lon.	Km		km	gal	gal	
1	04/23/79	31.24 N	35.46 E	33	5.1	62.4	20.1	24.2	
2	08/24/84	32.74 N	35.09 E	24	5.0	114.0	2.8	13.7	
3	10/18/84	33.22 N	35.65 E	20	4.4	158.8	0.1	6.7	
4	01/25/85	31.90 N	35.50 E	31	4.7	11.1	91.8	56.9	
5	04/27/87	31.28 N	35.48 E	10	4.2	57.9	7.9	13.6	
6	10/18/87	29.52 N	35.19 E	10	4.7	255.8	0.0	5.5	
7	10/23/87	30.94 N	35.78 E	10	4.3	100.6	1.4	9.3	
8	01/30/88	32.16 N	35.44 E	10	4.1	40.6	15.3	16.6	
9	03/02/88	33.25 N	34.62 E	33	3.6	188.6	0.0	3.3	
10	05/07/88	32.81 N	35.63 E	13	3.6	113.2	0.2	5.1	
11	05/13/88	33.15 N	35.61 E	10	3.4	150.6	0.0	3.5	
12	05/14/88	33.15 N	35.60 E	10	3.7	150.5	0.0	4.3	
13	09/05/88	33.15 N	34.34 E	33	3.7	197.9	0.0	3.4	
14	01/03/89	32.43 N	35.48 E	10	3.9	70.1	2.9	9.4	
15	09/13/90	32.00 N	34.80 E	10	3.9	80.9	1.7	8.4	
16	09/28/91	31.05 N	35.46 E	10	3.9	83.5	1.5	8.1	
17	01/11/92	31.24 N	35.38 E	10	3.7	63.7	3.0	8.8	
18	07/29/92	32.49 N	36.01 E	10	3.3	95.4	0.3	4.8	
19	09/07/92	31.30 N	35.55 E	10	3.7	55.9	4.4	9.8	
20	10/07/92	30.55 N	35.21 E	10	4.0	142.7	0.1	5.6	
21	04/24/93	33.15 N	35.62 E	24	3.6	150.7	0.0	4.0	
22	08/02/93	31.24 N	35.28 E	10	4.1	66.9	4.5	11.2	
23	08/03/93	29.68 N	34.14 E	10	4.6	280.0	0.0	4.7	
24	09/10/93	29.94 N	34.15 E	10	3.9	255.5	0.0	3.1	
25	01/03/94	29.99 N	34.05 E	10	3.9	257.8	0.0	3.1	
26	05/30/94	32.89 N	35.99 E	21	3.4	132.9	0.0	3.9	
27	06/24/94	30.14 N	34.05 E	10	3.7	245.0	0.0	2.8	
28	06/16/05	29.85 N	36.17 E	10	3.4	229.2	0.0	2.4	
29	09/16/94	32.00 N	35.68 E	10	4.2	29.9	27.6	22.1	
30	01/12/95	32.91 N	34.60 E	10	3.1	158.9	0.0	2.7	
31	02/17/95	29.75 N	35.00 E	10	3.5	234.6	0.0	2.5	
32	03/28/95	29.89 N	36.30 E	10	3.0	230.2	0.0	1.8	
33	08/08/95	32.41 N	35.53 E	15	3.5	67.9	1.7	7.3	
34	12/23/95	29.56 N	35.24 E	8	4.9	250.7	0.0	6.4	
35	02/04/96	29.75 N	34.80 E	10	4.1	240.8	0.0	3.8	
36	11/18/96	29.75 N	34.80 E	10	4.2	240.8	0.0	4.0	
37	03/26/97	33.39 N	35.45 E	10	5.6	176.9	1.2	14.3	
38	08/04/97	33.21 N	35.70 E	10	4.0	158.3	0.1	5.1	
39	04/25/98	29.61 N	34.25 E	10	4.1	280.3	0.0	3.3	
40	11/19/98	29.70 N	34.63 E	16	4.5	252.7	0.0	4.8	
41	10/28/99	30.41 N	35.14 E	10	4.3	159.6	0.1	6.2	
42	12/19/99	29.70 N	34.95 E	17	4.1	241.3	0.0	3.8	
43	02/11/04	31.67 N	35.55 E	26	5.3	15.5	117.4	73.2	
44	03/15/04	31.37 N	35.54 E	12	4.3	48.0	13.8	16.8	
45	07/07/04	31.96 N	35.57 E	11	4.7	19.4	66.4	41.9	
46	08/08/04	32.47 N	35.26 E	10	4.0	79.1	2.2	9.1	
47	10/28/04	29.95 N	34.39 E	9	3.8	239.9	0.0	3.1	
48	10/03/05	31.78 N	35.51 E	10	4.4	2.5	107.4	74.8	
49	09/09/06	32.02 N	35.49 E	1	4.5	24.5	46.0	31.4	
50	09/17/06	32.02 N	35.47 E	1	4.0	24.7	29.0	21.9	
51	09/26/06	33.49 N	34.55 E	10	3.5	215.5	0.0	2.7	
52	11/18/06	32.12 N	35.45 E	10	3.1	36.0	6.0	8.9	
53	02/09/07	31.07 N	35.58 E	2	4.0	81.6	2.0	8.9	
54	02/09/07	31.11 N	35.46 E	15	4.5	76.8	5.3	13.3	

Source of Information : National Earthquake Information Center (NEIC)
U. S. geological Survey Earthquake Data Base

NEIC: Earthquake Search Results

U. S. G E O L O G I C A L S U R V E Y

E A R T H Q U A K E D A T A B A S E

FILE CREATED: Mon Jul 30 02:47:34 2007

Geographic Grid Search Earthquakes= 54

Latitude: 33.500N - 29.500N

Longitude: 36.500E - 34.000E

Catalog Used: PDE

Date Range: Year: 1900 - 2007 Month: 01/Day: 01 Month: 06/Day: 30

Magnitude Range: 3.0 - 8.0

Depth Range: 0 - 100

Data Selection: Historical & Preliminary Data

CAT	YEAR	MO	DA	ORIG TIME	LAT	LONG	DEP	MAGNITUDE	IEFM NFPO TFS	DTSVNWG	DIST km
PDE	1979	04	23	130158.60	31.24	35.46	33	5.10 mb GS	.C .	....	
PDE	1984	08	24	060224.55	32.74	35.09	24	5.00 mb GS	.D M	....	
PDE	1984	10	18	071918.35	33.22	35.65	20	4.40 MLJER	.F .	....	
PDE	1985	01	25	060803.82	31.90	35.50	31	4.70 MLJER	.D .	....	
PDE	1987	04	27	204146.32	31.28	35.48	10	4.20 MLJER	.. .	....	
PDE	1987	10	18	010541.86	29.52	35.19	10	4.70 MLJER	.F .	....	
PDE	1987	10	23	163231.38	30.94	35.78	10	4.30 MLBHL	.F .	....	
PDE	1988	01	30	03	32.16	35.44	10	4.10 MLJER	.F .	....	
PDE	1988	03	02	144509.35	33.25	34.62	33	3.60 MLJER	.. .	....	
PDE	1988	05	07	201735.70	32.81	35.63	13	3.60 MLJER	.F .	....	
PDE	1988	05	13	224843.03	33.15	35.61	10	3.40 MLBHL	.F .	....	
PDE	1988	05	14	003119.11	33.15	35.60	10	3.70 UKHLW	.F .	....	
PDE	1988	09	05	143328.18	33.15	34.34	33	3.70 MLBHL	.F .	....	
PDE	1989	01	03	171046.08	32.43	35.48	10	3.90 MLJER	5F .	....	
PDE	1990	09	13	121000.51	32.00	34.18	10	3.90 MLCSS	3F .	....	
PDE	1991	09	28	004307.04	31.05	35.46	10	3.90 MDRYD	.F .	....	
PDE	1992	01	11	034631.04	31.24	35.38	10	3.70 MDHLW	.. .	....	
PDE	1992	07	29	053043.38	32.49	36.01	10	3.30 MLCSS	.. .	....	
PDE	1992	09	07	025751.65	31.30	35.55	10	3.70 MDRYD	.. .	....	
PDE	1992	10	07	214114.28	30.55	35.21	10	4.00 MDRYD	.. .	....	
PDE	1993	04	24	034513.90	33.15	35.62	24	3.60 MLJER	.F .	....	
PDE	1993	08	02	231644.84	31.24	35.28	10	4.10 MDHLW	.. .	....	
PDE	1993	08	03	132942.46	29.68	34.14	10	4.60 mb GS	.. .	....	
PDE	1993	09	10	194855.53	29.94	34.15	10	3.90 MDHLW	.. .	....	
PDE	1994	01	03	082101.65	29.99	34.05	10	3.90 MDHLW	.. .	....	
PDE	1994	05	30	215844.64	32.89	35.99	21	3.40 MLBHL	.. .	....	
PDE	1994	06	24	204359.68	30.14	34.05	10	3.70 MLBHL	.. .	....	
PDE	1994	09	05	095349.78	29.85	36.17	10	3.40 MDRYD	.. .	....	
PDE	1994	09	16	031854.81	32.00	35.68	10	4.20 MDHLW	.F .	....	
PDE	1995	01	12	133242.48	32.91	34.60	10	3.10 MLBHL	.F .	....	
PDE	1995	02	17	043329.54	29.75	35.00	10	3.50 MDRYD	.. .	....	
PDE	1995	03	28	091201.01	29.89	36.30	10	3.00 MDRYD	.. .	....	
PDE	1995	08	08	001552.47	32.41	35.53	15	3.50 MLJER	.F .	....	
PDE	1995	12	23	062858.38	29.56	35.24	8	4.90 MLJER	.. .	....	
PDE	1996	02	04	121632.07	29.75	34.80	10	4.10 MLJER	.. .	....	

PDE	1996	11	18	093607.02	29.75	34.80	10	4.20	MLJER	.. . .
PDE	1997	03	26	042251.63	33.39	35.45	10	5.60	MLJER	.D . ...
PDE	1997	08	04	112946.70	33.21	35.70	10	4.00	MLJER	.. . .
PDE	1998	04	25	012930.04	29.61	34.25	10	4.10	MLGII	.. . .
PDE	1998	11	19	120933	29.70	34.63	16	4.50	MLGII	.. . .
PDE	1999	10	28	153913.45	30.41	35.14	10	4.30	mb GS	.F . ...
PDE	1999	12	19	084249.10	29.70	34.95	17	4.10	MLGII	.. . .
PDE	2004	02	11	081503.83	31.67	35.55	26	5.30	MwHRV	.C M ......S
PDE	2004	03	15	234956	31.37	35.54	12	4.30	MLGII	.F . ...
PDE	2004	07	07	143508.02	31.96	35.57	11	4.70	MLGII	.F . ...
PDE	2004	08	08	124230	32.47	35.26	10	4.00	MLGII	.F . ...
PDE	2004	10	28	071032.20	29.95	34.39	9	3.80	MLGII	.. . .
PDE	2005	10	03	040525.61	31.78	35.51	10	4.40	mb GS	.F . ...
PDE-W	2006	09	09	045808	32.02	35.49	1	4.50	mb GS	.F . ...
PDE-W	2006	09	17	082250	32.02	35.47	1	4.00	MLGII	.F . ...
PDE-W	2006	09	26	052903.78	33.49	34.55	10	3.50	MDISK	.. . .
PDE-W	2006	11	18	025757.15	32.12	35.45	10	3.10	MLNIC	.. . .
PDE-W	2007	02	09	221207.37	31.07	35.58	2	4.00	mb GS	3F . ...
PDE-W	2007	02	09	221408.90	31.11	35.46	15	4.50	mb GS	3F . ...
